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PSEUDOMONADACEAE AND FOOD PROCESSING

VOLUMES 1-5

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## INTRODUCTION

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J. NEWTON  
ASSISTANT EDITOR





1 R 11

[Study of quality of smoked fish.]

Czarnowska, W.; Szymikowski, J.

Roczniki Państwowego Zakładu Higieny 19 (3) 311-16 (1968) [3 ref. Pl, ru, en] [Wojewódzka Stacja Sanitarно-Epidemiologiczna, Gdansk, Poland]

Examination of 157 samples of hot-smoked cod, flounder, sprat, mackerel and herring and 35 samples of cold-smoked herring obtained directly from the smokehouse or on the wholesale or retail market showed absence of coliforms and enterococci in 0.1 g tissue. Total bacterial counts/g were 0 in 12 samples, 1000 in 139, 1000-50 000 in 40 and 50 000 in 1, the bacteria mostly belonging to the *Pseudomonas*, *Achromobacteraceae* and *Bacillus subtilis* groups. Coagulase-positive staphylococci were isolated from 1 sample. Moulds (*Penicillium*, *Aspergillus* and *Mucor*) were detected in 5 samples. Values are given for contents of salt, phenol and volatile bases and acids and organoleptic assessment is given. Bacterial counts were less in heavily smoked fish. SKK

2 B 40

Tolerance of bacteria for quaternary ammonium compounds.

Soprey, P. R.; Maxcy, R. B.

Journal of Food Science 33 (5) 536-40 (1968) [13 ref. En] [Dept. of Food Sci. and Technology, Univ. Lincoln, Nebraska 68503, USA]

When grown in gradient concn. of quaternary ammonium compounds, bacteria gained increasing tolerance, which resulted in more frequent occurrence of individual cells at the plateau of max. tolerance. A similar but reverse pattern appeared with loss of tolerance. *Escherichia coli* approached a tolerance at 28 µg/ml in nutrient broth after 12-14 daily transfers. *Pseudomonas fluorescens* adapted more rapidly in a similar medium, reaching a level of 120 µg/ml in 12 days. The adapted cells were more resistant to quaternary ammonium compounds at low concn. in germicidal effectiveness tests, but at levels of standard sanitizing recommendations there was no difference between the normal and the adapted cultures. AS

2 B 42

Interactive inhibitory activity among certain psychrophilic bacteria from dairy foods.

Vanderzant, C.; Custer, C. S.

Bacteriological Proceedings 1968: 12 (1968) [En] [Texas A &amp; M Univ., Coll. Sta., USA]

38 cultures, including *Pseudomonas*, *Achromobacter*, and *Alcaligenes* spp., were examined for interactive inhibitory activities by the spot-plate method. 11 *Pseudomonas* cultures showed inhibitory activity against 7 *Achromobacter* spp. Of *Pseudomonas* spp., 8 showed inhibitory activity against 4 others. Neither *Achromobacter* nor *Alcaligenes* spp. were inhibitory against the other cultures. Inhibition was more pronounced at 7° than at 25°C and increased with increasing concn. of effector species and decreasing concn. of test species. When interacting spp. of *Pseudomonas* and *Achromobacter* were grown

together in broth or skim-milk media, inhibition of the *Achromobacter* sp. occurred when the viable population level of the *Pseudomonas* sp. had reached 10<sup>6</sup>-10<sup>8</sup> cells/ml. Sterile Seitz-filtered filtrates of a *Pseudomonas* sp. inhibited growth of an *Achromobacter* sp. [See also J. Dairy Sci. (1968) 51 (7) 991-95.] AS

3 B 63

[Incidence and bacteriological characterization of *Pseudomonas aeruginosa* in raw milk.] *Pseudomonas aeruginosa*: Untersuchungen über das Vorkommen in Rohmilch und die bakteriologische Charakterisierung.

Kielwein, G.; Gerlach, R.; John, H.

Archiv für Lebensmittelhygiene 19 (7) 145-54 (1968) [29 ref. De] [Staatliches Tierärztliches Untersuchungsamt Aulendorf, W. Germany]

*Ps. aeruginosa* was isolated from 69 of 1022 samples of raw milk (6.7%), at a mean level of 1683/ml (range, 10-10 000/ml). In 53 of these 69 samples, other pseudomonads were also isolated, at a mean level of 11 130/ml (range, 30-300 000/ml). On the basis of biological and biochemical characterization of 58 *Ps. aeruginosa* cultures, the following criteria for identification of this species in the absence of pyocyanin formation are proposed: haemolysis on blood agar, positive cytochrome oxidase reaction; oxidative glucose degradation, growth in nutrient broth at 42°C, typical growth in quinic acid medium (Korth) and reaction in litmus milk. [See also Arch. Lebensmittelhyg. (1968) 19 (2) 25-30.] HBr

3 B 77

Interactive inhibitory activities among certain psychrotrophic bacteria from dairy foods.

Vanderzant, C.; Custer, C. S.

Journal of Milk and Food Technology 31 (10) 302-05 (1968) [21 ref. En] [Dept. of Animal Sci., Texas A&amp;M Univ., Coll. Sta., USA]

See FSTA (1969) 1 2C50.

3 B 83

Effect of γ-irradiation on the microflora of rice.

Iizuka, H.; Ito, H.

Cereal Chemistry 45 (5) 503-11 (1968) [10 ref. En] [Inst. of Applied Microbiology, Univ., Tokyo, Japan]

Unpolished and polished rice harvested in Japan and polished rice imported from Spain, were investigated. Chromogenic *Pseudomonas* (i) and fluorescent *Pseudomonas* (ii) were the microflora of unirradiated, unpolished or polished Japanese rice. Of micro-organisms found on Spanish rice 20-30% were moulds, the rest were (i) and (ii). The principal micro-organisms of rice which were chiefly responsible for rice damage, include moulds such as *Penicillium* and *Aspergillus* which can be sterilized with 0.2-0.3 Mrad. When rice was irradiated with 0.2-1.2 Mrad, red *Pseudomonas* was the main survivor. Radiation-resistant yeasts have been isolated from unpolished rice irradiated with 1 Mrad or more. No increase in the number of micro-organisms was observed on irradiated rice packed in a polyethylene pouch after storage for 30 days at 10° and 30°C. AS







## 3 G 87

## Production of tartaric acid by fermentation.

Krumphanzl, V.; Dyr, J.; Honzova, H.; Pardon, J. *Sbornik Vysoke Skoly Chemicko-Technologicke v Praze, E-Potravims* 21: 19-24 (1968) 122 ref. En, cs, ru. VSCHT, fakulta potravinarske technologie, katedra kvasne chemie a technologie, Prague, Czechoslovakia

The possibility of preparing tartaric acid by controlled fermentation was investigated, i.e. by oxidation of glucose by several strains of *Acetobacter suboxydans* using various concn. of vanadium dioxide as catalyser. Various concn. of corn-steep, fermentation autolysate and wort were tested as media. Under expt. conditions during fermentation only the formation of 5-keto-gluconic acid, but not of tartaric acid, was proved.

Tartaric acid was prepared after the isolation of 5-keto-gluconic acid by chemical oxidation in the presence of vanadium dioxide. STI

## 3 R 83

Post mortem degradation of fish muscle proteins: the role of proteolytic *Pseudomonas* spp. and their mechanism of action.

Chung, J. R.

Dissertation Abstracts, Section B 29 (3) 1056

(1968) [En] [Univ. of Washington, Seattle, USA]

The proteinase system of a proteolytic strain of *Pseudomonas* sp. was investigated. These extracellular enzymes were inactivated above 50°C and had an optimum activity at pH 9. Proteinase production was regulated by induction and repression which provided a basis for interpreting fish spoilage. Amino acids of the non-protein N (NPN) components of fish muscle, repressed proteinase production. As NPN was removed by developing microflora, the amino acid concn. decreased to a point where proteinase synthesis was induced by proteins. During early spoilage *Pseudomonas* spp. outgrew other groups. As the NPN concn. decreased the activity of proteolytic *Pseudomonas* spp. replenished NPN through protein breakdown giving these spp. an added advantage for growth over non-proteolytic bacteria. This accounts for the eventual dominance of *Pseudomonas* spp. in normal fish spoilage. JA

## 4 B 166

## Microbial profiles of fresh beef.

Stringer, W. C.; Bilskie, M. E.; Naumann, H. D. *Food Technology* (Champaign) 23 (1) 97-102 (1969) [21 ref. En] [Dept. of Food Sci. and Nutrition, St. Univ., Columbia, Missouri 65201, USA]

Immediately after slaughtering, carcasses contained high levels of microbial contamination and moister carcass areas were the most highly contaminated. Amount of contamination increased slightly after chilling and there was a larger increase during transportation to the retail store. The logarithm of the mean counts/in<sup>2</sup> from the areas sampled was 4.70 after slaughter, 4.78 prior to shipment from the plant and 5.94 on arrival at the retail store. Small seasonal and weekly variations were observed in initial carcass contamination, but larger differences were

noted, in microbial populations among various lots of cattle. Predominant micro-organisms present on carcasses at the packing plant were *Pseudomonas fragi*, *Ps. geniculata* and *Micrococcus luteus*. *Ps. fragi* and *Ps. geniculata* were the predominant organisms present on carcasses, loins and steaks at the retail store. AS

## 4 B 167

## A bacteriological study of stored, sulphite treated peeled potatoes.

Lund, B. M.

*Journal of Applied Bacteriology* 31 (4) 479-92 (1968) [33 ref. En] [Agric. Res. Council, Food Res. Inst., Colney Lane, Norwich, Norfolk, England]

Peeled, sulphited, King Edward potatoes were stored at 23°C for 3 days or at 6°C for 7 days in stainless steel trays covered with (i) perforated or (ii) unperforated polyethylene or with (iii) Saran (vinylidene chloride-vinyl-chloride copolymer). Analysis of gas from the sealed packs after storage showed a marked increase in CO<sub>2</sub> concn. with a corresponding decrease in O<sub>2</sub> concn. Potatoes stored in (i) developed extensive wet, green patches, fluorescing strongly under UV light, in (ii) this occurred to a slight extent, but was not observed with (iii). Viable counts were made of micro-organisms in potato samples. Samples stored in (ii) and (iii) tended to have lower counts than those stored in (i), this being more apparent with samples stored at 6°C. At 23°C the major isolates were Enterobacteriaceae and fluorescent pseudomonads. Isolates from storage at 6°C were all pseudomonads, mostly fluorescent. 28% of the pseudomonads, but none of the fermentative isolates were pectolytic. Effects of sulphite and gas composition changes on microbial growth in the potatoes are discussed. JA

## 4 H 442

## Diet-type beverage.

Schupper, H. R. (Kelco Co.)

United States Patent 3 413 125 (1968) [En]

This patent covers aqueous carbonated non-alcoholic, diet-type beverages containing *Xanthomonas hydrophilic* colloids. IFT

## 4 T 140

## Rehydration additive.

Edlin, R. L. (Kelco Co.)

Canadian Patent 802 145 (1968) [En]

Rehydration characteristics of dehydrated food products are improved by incorporation of small amounts of *Xanthomonas hydrophilic* colloids. IFT

## 5 B 186

## Microbial utilization of methane.

Whittenbury, R.

*Process Biochemistry* 4 (1) 51-56 (1969) [17 ref. En] [Dept. of Microbiology, Univ. Edinburgh, Scotland]





The culture of micro-organisms on methane to provide a supplementary source of protein is discussed. Obtaining a pure culture of micro-organisms proved difficult but a method of isolation and cultivation is described. It involved inoculating soil, mud or water from ditches, ponds or streams into a conventional inorganic salts medium in 100 ml bottles, capping and injecting with 20 ml methane and incubating at 30 or 45°C. Growth occurred usually within 7 days. Enrichments were diluted to  $10^{-6}$ , spread-plated, the plates allowed to dry and then incubated in a vacuum desiccator containing ~30% methane in the atm. Some isolates were identified as *Pseudomonas methanica* and *Methylococcus capsulatus*, but the majority were unidentified spp. The problems of assessing micro-organisms most suitable for protein production and the difficulties in methane oxidation are discussed. The distinguishing characteristics of methane oxidizing micro-organisms are given. AL

## 5 B 199

Bacterial flora of chicken carcasses treated with high concentrations of chlorine.

Patterson, J. T.

*Journal of Applied Bacteriology* 31 (4) 544-50 (1968) [13 ref. En] [Queen's Univ., Elmwood Avenue, Belfast, N. Ireland]

Freshly eviscerated broiler carcasses which had been washed with 10-15 ppm available  $\text{Cl}_2$  were immersed for 4 h in chilled water (6°C) containing 200 or 400 ppm free residual  $\text{Cl}_2$ . After immersion the carcasses were allowed to drip for  $\frac{1}{2}$  h, then placed in polyethylene bags and stored at 1°C. Daily examinations were made to detect changes in smell. Samples of carcass for bacterial counts were taken before storage and at spoilage.  $\text{Cl}_2$  treatment extended shelf-life by ~20%. Initial flora contained a high proportion of Gram positive cocci and yeasts. On spoilage Gram negative, oxidase positive short rods constituted ~90% of the flora, in both  $\text{Cl}_2$ -treated carcasses and controls, most of these being classified as *Pseudomonas*. Conclusions are that stored, refrigerated carcasses treated at high  $\text{Cl}_2$  levels undergo normal spoilage. JA

## 5 C 205

Ecosystems of food-contact surfaces.

Chaturvedi, S. K.; Maxcy, R. B.

*Food Technology (Champaign)* 23 (1) 67-70 (1969) [27 ref. En] [Dept. of Food Sci. and Technology, Univ., Lincoln, Nebraska 68503, USA]

Interactions between micro-organisms, milk films, milk solids in suspension, disinfectant residues in presence of milk soil, and soil residues on washed surfaces were studied using glass and stainless steel slides. Bacteria in fresh raw milk ( $\sim 200 \times 10^3$  organisms/ml) inoculated onto prepared milk films, showed low capacity for survival, whereas numbers of bacteria surviving drying in soil were related to available nutrients in the soil. When surfaces were soiled with milk, washed to produce visible cleanliness, then inoculated with suspensions of *Pseudomonas fluorescens*, *Escherichia coli*, *Microbacterium lacticum* and *Streptococcus lactis* in distilled water, growth of the organisms was possible,

particularly on the stainless steel surface. Quaternary ammonium compounds showed greater antibacterial potential than hypochlorite solutions in presence of milk soil; antibacterial activity diminished with increasing soil level, particularly on the stainless steel surface. The importance of the nature of the surface in bactericidal evaluation of disinfectants is stressed. CDA

## 5 S 349

Ozone treatment of chilled beef. I. Effect of low concentrations of ozone on microbial spoilage and surface colour of beef.

Kaess, G.; Weidemann, J. F.

*Journal of Food Technology* 3 (4) 325-34 (1968) [10 ref. En] [CSIRO Meat Res. Lab., Cannon Hill, 4170, Queensland, Australia]

Fresh meat slices held under equilibrium relative humidities (EH) of 99.3, 98.5 and 98.0%, were exposed to concn. of ozone (i) (in mixture with air) ranging from 0.15 to 5 mg/m<sup>3</sup>. Some meat samples were inoculated with meat spoilage non-pigmented and pigmented *Pseudomonas* spp., *Candida scottii* and *Thamnidium* and *Penicillium* spp. The meat was examined for colour and odour and microbial counts were made. Population densities of non-pigmented *Pseudomonas* spp. and of *Candida scottii* showed significant decrease at (i) concn. of  $\geq 2$  mg/m<sup>3</sup> (EH = 99.3%). The lag phase of pigmented *Pseudomonas* sp. was retarded with lower (i) concn., but there was less effect on non-pigmented *Pseudomonas* sp. The slime point was increased from  $10^8$  organisms/cm<sup>2</sup> to  $10^9$ /cm<sup>2</sup> by (i) concn. of 0.6 mg/m<sup>3</sup>. This effect was enhanced by lowering the EH or by addition of 11%  $\text{CO}_2$ . The lag phase of *Thamnidium* and *Penicillium* was greatly increased under (i) concn. of 0.16-5.0 mg/m<sup>3</sup>. There was no aerial mycelium formation at (i) concn.  $\geq 0.6$  mg/m<sup>3</sup>. The colour of the meat is not affected by (i) concn.  $\leq 0.6$  mg/m<sup>3</sup>. TW

## 6 B 238

Effects of selected food additives on growth of *Pseudomonas fragi*.

Moustafa, H. H.; Collins, E. B.

*Journal of Dairy Science* 52 (3) 335-40 (1968) [18 ref. En] [Dept. of Food Sci. and Technology, Univ., Davis, California, USA]

Various food additives were tested for inhibitory effect on *Pseudomonas fragi* (isolated from Cottage cheese) grown in lactose-yeast extract broth, and those causing inhibition were further tested on the organism grown in skim-milk and half-and-half. Nisin, bacitracin, muramidase and nitrofurazone were ineffective in broth; chloramphenicol increased the lag phase in broth and resulted in chloramphenicol resistant populations; EDTA, muramidase + EDTA, propyl-p-hydroxybenzoate and chlortetracycline inhibited growth in broth, but not in skim-milk or half-and-half; sodium benzoate increased the lag phase in broth at pH 5.2, but not at pH 6.5; potassium benzoate inhibited growth in all media at pH 5.5 and 5.2, but not at pH 6.5. CDA

## 6 B 276

[Prevalence of *Aeromonas hydrophila* in raw milk.]

Untersuchungen über das Vorkommen von *Aeromonas hydrophila* in Rohmilch.

Kielwein, G.; Gerlach, R.; Johne, H.





Archiv für Lebensmittelhygiene 20 (2) 34-38 (1969) [20 ref. De] [Staatl. Tierärztliches Untersuchungsamt, 796 Aulendorf, W. Germany]

Aeromonas organisms were detected at levels of  $10^2$ - $10^5$ /ml in 214 of 1248 samples of raw milk, mainly from samples containing  $10^3$ - $10^5$  pseudomonas/ml. 57 isolates (on penicillin-phenol red-starch agar), were classified from bacteriological tests, 16 as *Aer. hydrophila* and 41 as *Aer. hydrophila* var *anaerogenes*. Numbers of isolates resistant to various antibiotics are recorded; most were completely resistant to penicillin and colistin, but very few were resistant to streptomycin, tetracycline, kanamycin, rifamycin and gentamycin; some were resistant to chloramphenicol, neomycin, polymyxin and nalidixin. It is concluded that bacteriological milk hygiene tests should include detection of aeromonads since these organisms, which originate in the water supply and cowshed dirt, are able to grow at 4°C. CDA

#### 6 H 572

##### Tea cider - a potential winner.

Silva, R. L. de; Saravanapavan, T. Y.

Tea Quarterly 39 (3) 37-41 (1968) [1 ref. En]

The ingredients, utensils and procedure for preparing tea cider and vinegar are described. The ferment can be obtained from the Tea Res. Inst. of Ceylon. The basic process is fermentation of sugar by *Saccharomyces ludwigii* and *Acetobacter xylinum*, with tea used as flavouring agent. Alcohol content is ~1%. RM

#### 7 B 288

##### Detection and incidence of specific species of spoilage bacteria on fish. I. Methodology.

Levin, R. E.

Applied Microbiology 16 (11) 1734-37 (1968) [9 ref. En] [Dept. of Food Sci. and Technology, St. Univ., Amherst, Massachusetts 01002, USA]

Pour plates of peptone-Fe-agar were used to determine the numbers of *Pseudomonas putrefaciens* on haddock fillets. This organism, which forms  $H_2S$ , produced intensely black sub-surface colonies and black or grey surface colonies. The number of proteolytic (gelatin hydrolysing) organisms in fish tissues was estimated by using a soft-agar-gelatin overlay technique. TFF

#### 7 B 289

##### Detection and incidence of specific species of spoilage bacteria on fish. II. Relative incidence of *Pseudomonas putrefaciens* and fluorescent pseudomonads on haddock fillets.

Chai, T.; Chen, C.; Rosen, A.; Levin, R. E. Applied Microbiology 16 (11) 1738-41 (1968) [8 ref. En]

*Pseudomonas putrefaciens* was usually <1% of the total count on fresh fillets whereas it comprised 50-90% when the total count was > $10^6$ /g of tissue. The fluorescent pseudomonads constituted ≤ 19.3% of the total population after 8 days at 2°. Out of a total of 45 fluorescent cultures isolated

from haddock, 14 (31.1%) produced spoilage odours of strong intensity on haddock at 2°. Proteolytic organisms other than *Pseudomonas putrefaciens* and fluorescent pseudomonads increased at a slower rate than these 2 groups. TFF

#### 7 C 349

##### *Herellea* (*Acinetobacter*) and *Pseudomonas ovalis* (*P. putida*) from frozen foods.

Eller, C.

Applied Microbiology 17 (1) 26-30 (1969) [37 ref. En] [Biosci. Division, USAF School of Aerospace Med., Brooks Air Force Base, Texas 78235, USA]

364 samples of frozen foil-packed foods (pre-cooked meats and vegetables and uncooked vegetables and desserts) were examined for the presence of bacteria by the procedure used for detecting salmonellae in frozen foods. 17 strains of *H. vaginicola* (*A. anitratus*) and 8 of *P. ovalis* (*P. putida*) were isolated from 23 (6.3%) of the samples and their morphological and biochemical characteristics investigated. The pseudomonad simulated the characteristics of *Herellea* on Sellers differential agar, except for the fact that it fluoresced. The habitat and pathogenicity of *Herellea* and *Mima* are discussed but their significance in foods remains unanswered. AL

#### 7 B 291

##### [Occurrence of short-rod bacilli in brewing.] Zum Befund "Kurzstäbchen". [A lecture]

Leipner, W.

Brauwelt 109 (28/29) 517-24 (1969) [20 ref. De, en, fr] [Wissenschaftliche Sta. für Brauerei, Munich, W. Germany]

Lactobacilli, *Acetobacter* spp. and flavobacteria cause spoilage in the finished wort and beer but pediococci affect the finished beer only. The proteolytic coliforms produce off-flavours and reduce growth factors and vitamins required for yeast growth. Autolysis products from yeast provide the nutrient requirements of the contaminants, particularly in the lagering tank. In general, filtration removes them but the products of metabolism remain in the beer and cause flavour deterioration. Wort production in enclosed vessels, contaminant-free yeast cultures and hygienic filling are required. BR





8 B 309

**Factors affecting resistance to heat and recovery of heat-injured bacteria.**

Dabbah, R.; Moats, W. A.; Mattick, J. F.  
*Journal of Dairy Science* 52 (5) 608-14 (1969) [31  
 ref. En] [Market Quality Res. Division, USDA,  
 Beltsville, Maryland 20705, USA]

An unidentified *Pseudomonas* sp. isolated from pasteurized milk stored at 4°C appeared to be killed by a heat treatment of 55°C for 30 min, since no colonies formed on trypticase soya agar plates during incubation for 48-72 h. However, when the heated bacteria were held in trypticase soya broth for 48-72 h at 20°C or 2-3 wk at 4°C, some cells recovered ability to grow normally. Heat resistance and recovery were affected by the physiological state of the bacteria and the nature of the heating and the recovery medium. More complex heating media, including milk whey, stabilized the bacteria to heat, and favoured recovery. Recovery was also found with 5 species of *Salmonella* and is probably a general phenomenon after heating at time/temp. combinations just above those which are apparently lethal. AS

8 B 324

**Inhibition of food spoilage *Pseudomonas* by *Lactobacillus* species.**

Lee, J. S.; Price, R. J.  
*Bacteriological Proceedings* 1969: 13 (1969) [En]  
 [St. Univ., Corvallis, Oregon, USA]

Heavy growth of *Lactobacillus* in oysters has been observed despite the high initial number of *Pseudomonas* present. Since the flora change took place under conditions that favoured the growth of *Pseudomonas*, an interaction between the 2 genera was suspected. 2 test cultures were grown in a common medium in a Bellco spinner flask, which separated the cells by a semipermeable membrane. The growths of 2 cultures at 7°, 15° and 30°C were determined by optical density and by viable count. 3 *Lactobacillus* spp. isolated from oysters all inhibited the growth of 6 *Pseudomonas* spp. isolated from various seafoods. The inhibition was most marked against Type III *Pseudomonas* spp., which has been classified as the 'spoilage'. *Lactobacillus*, however, did not inhibit the growth of *Salmonella typhimurium* or *Escherichia coli*. The anti-*Pseudomonas* substance accumulated in *Lactobacillus* growth medium and could be concentrated by freeze-drying. The max. effectiveness was observed at pH 6.7. Autoclaving and 0.5N perchloric acid treatment destroyed the activity. AS

8 P 731

**Effect of hydrogen peroxide treatment of milk on its proteolysis by *Pseudomonas fluorescens*.**

Fish, N. L.; Pinkston, P. J.; Claydon, T. J.; Mickelsen, R.  
*Journal of Dairy Science* 52 (5) 619-24 (1969) [11  
 ref. En] [Dairy Dept., St. Univ., Manhattan,  
 Kansas 66502, USA]

Studies were made on H<sub>2</sub>O<sub>2</sub> treatment of milk as a possible means of increasing proteolysis by *Ps. fluorescens*. Reconstituted dried skim-milk was treated for 20 min with H<sub>2</sub>O<sub>2</sub> (to give a 1% concn.)

and with catalase, autoclaved, inoculated with *Ps. fluorescens* and incubated at 25°C for 14 days. Undigested protein was precipitated at pH 4.6 either immediately or after lactic fermentation with yoghurt culture for 4 days. H<sub>2</sub>O<sub>2</sub> treatment did not affect gross composition of the milk, but after proteolysis ninhydrin values and protein equivalents of supernatant were higher than those of controls, and wt. of undigested precipitate was <½ that of controls. Protein equivalent was higher in samples subjected to lactic fermentation, indicating that proteolysis had continued during the 4 additional days of fermentation. It is concluded that decreased wt. of precipitate from proteolysate of H<sub>2</sub>O<sub>2</sub>-treated milk resulted largely from increased proteolysis in the treated milk. [See also *Fd Technol.*, Champaign (1968) 22 (2) 215-18.] CDA

8 T 235

**Turn nonfat dry into meat flavour for extra profit.**

Claydon, T. J.; Mickelsen, R.  
*American Dairy Review* 31 (4) 32-33 & 79 (1969) [4  
 ref. En] [Dept. of Dairy and Poultry Sci., St.  
 Univ., Manhattan, Kansas, USA]

A modified method is described for the preparation of a beef-extract type flavouring by proteolysis of reconstituted non-fat milk solids by *Pseudomonas fluorescens*. Improved flavour, especially elimination of 'burned' defect, was obtained by subsequent 75% reduction of lactose content by fermentation with lactic acid bacteria and neutralization to pH 5.8-6.0. TS of the product were ~27% of which total N was 1.6%, mostly in amino acid form. Toxicity tests produced no adverse effects on rats. Taste tests indicated improved flavour in several food preparations which was equal or preferable to the effect of a commercial vegetable protein hydrolysate similarly tested. JK

9 B 329

**Growth characteristics of *Pseudomonas fluorescens* on ovalbumin substrates.**

Nikoopour, H.; Gardner, F. A.  
*Poultry Science* 47 (6) 1780-87 (1968) [14 ref. En]  
 [Poultry Sci. Dept., A&M Univ., Coll. Sta., Texas  
 77840, USA]

3 strains of *Ps. fluorescens* isolated from poultry or dairy products were incubated on purified ovalbumin substrates containing 0.5, 1.0 and 2.0% protein, at pH 7.5 and 8.5 and temp. of 15°, 20° and 25°C for 28 days. Growth rate and fluorescence development were higher at pH 7.5 than at pH 8.5, but there was little difference in the final extent of growth. Growth on 0.5% protein substrate was less than on the higher protein level substrates; the growth promoting effect of the protein substrates was more pronounced at 15° than at 20° or 25°C. TW

9 G 363

**[Yeast preparation.]**

Niigata Shuzo KK

Japanese Patent 6613/69 (1969) [Ja]

Yeast is prepared by the anaerobic fermentation of nitrate-containing media by a new sp. of *Pseudomonas* 37330-0. IFT





9 H 927

Diet-type beverage concentrate.

Schuppner, H. R. (Kelco Co.)

Canadian Patent 811 680 (1969) [En]

The concentrates for preparing aqueous carbonated non-alcoholic diet-type beverages have good mouth-feel characteristics and contain a *Xanthomonas* hydrophilic colloid. IFT

9 P 823

[Biological characteristics of pseudomonads and aeromonads of importance in milk hygiene.]

Untersuchungen über einige milchhygienisch bedeutungsvolle biologische Eigenschaften von Pseudomonaden und Aeromonaden.

Kielwein, G.; Johne, H.; Gerlach, R.

Archiv für Lebensmittelhygiene 20 (3) 55-61

(1969) [6 ref. De] [Staatl. Tierärztl.

Untersuchungsamt, Aulendorf, W. Germany]

Lab. cultures of *Pseudomonas aeruginosa*, *Ps. fluorescens*, *Ps. putida*, *Ps. putrefaciens*, *Ps. fragi*, *Aeromonas hydrophila*, and *Aeromonas hydrophila* var. *anaerogenes* were investigated for their possible influence on the hygienic quality of milk. These organisms grew at 5°C, pasteurization did not kill all the spp., and the proteases and lipases produced by these organisms were particularly heat resistant. QAC's were effective against these organisms in the presence of milk residues. Heated cultures of pseudomonads and aeromonads promoted growth and therefore lactic acid production of streptococci.

BR

9 P 840

[Origin and activity of *Pseudomonas aeruginosa* in milk.]Herkunft und Wirkung von *Pseudomonas pyocyanea* in der Milch.

Grün, L.

Milchwissenschaft 24 (1) 14-16 (1969) [5 ref. De,

en] [Inst. für Hygiene, Univ., Düsseldorf, W.

Germany]

39 of 45 raw milk samples stored for 2-3 days at 4°C were found to be contaminated with *Ps. aeruginosa*, counts varying from 100 to >1 000 000/ml. This incidence of contamination (87%) was considerably greater than that (6.7%) reported by Kielwein et al. [See FSTA (1969) 1 3B63].

Preliminary results of further expt. indicated the main source of contamination to be the water supply, since all of 15 cocks and pipes connected to mains water and 7 of 9 connected to an individual supply were found to be contaminated with *Ps. aeruginosa*. Further tests to determine the effect of an inhibitory substance 'pyocyanase' on the growth of the Gram-positive *Ps. aeruginosa* in milk indicated that both after incubation at 37°C and after growth at 3°C, its presence could be detected only when the milk had a bacterial count of  $1-2 \times 10^9$ /ml. HBr

10 P 1041

Effects of hydrogen peroxide on growth of *Pseudomonas fragi* and shelf life of pasteurized half-and-half.

Collins, E. B.; Dirar, H. A.

Journal of Dairy Science 52 (7) 962-67 (1969) [20 ref. En] [Dept. of Food Sci. and Technology, Univ., Davis, California 95616, USA]

Concn. of 0.003 to 0.009%  $H_2O_2$  were added to autoclaved milk and 0.005% to pasteurized milk, half-and-half and skim-milk, each containing  $\sim 10^6$  *Ps. fragi* organisms/ml. Plate counts were made on lactose-yeast extract agar. *Ps. fragi* counts of  $\sim 10^6$  in  $H_2O_2$ -treated autoclaved milk decreased to  $\sim 10^4$ - $10^5$ /ml after 12 h then increased, and after 2-5 days counts were similar to those of corresponding controls ( $10^7$ - $10^8$ /ml). Samples treated with the higher concn. of  $H_2O_2$  showed the most marked decrease and subsequent rate of increase in numbers. With an initial population of 1-2 *Ps. fragi*/ml, concn. of >0.005%  $H_2O_2$  delayed attainment of max. populations in autoclaved milk by  $\geq 45$  days.  $H_2O_2$  was more effective against *Ps. fragi* in autoclaved than in pasteurized or skim-milk, possibly due to destruction of peroxidase by autoclaving. Growth of *Ps. fragi* was stimulated by aeration and increase in incubation temp. up to 23°C, but pH between 5.5 and 8.6 had little effect. Shelf-life of commercial half-and-half, both with and without addition of *Ps. fragi*, was increased by addition of  $H_2O_2$ ; the concn. of  $H_2O_2$  used were not detected by organoleptic analysis. [See also FSTA (1969) 1 6B238] CDA

11 B 338

[Nutrient medium for the selective cultivation of pseudomonads and aeromonads.] Ein Nährboden zur selektiven Züchtung von Pseudomonaden und Aeromonaden.

Kielwein, G.

Archiv für Lebensmittelhygiene 20 (6) 131-33

(1969) [6 ref. De] [Staatliches Tierärztliches

Untersuchungsamt, Milchabteilung, Hauptstr. 8/1.,

796 Aulendorf, W. Germany]

2 g  $KH_2PO_4$ , 0.5 g  $MgSO_4$  and 10 g sodium L-(+)-glutamate are dissolved in 900 ml distilled water and adjusted to pH 7.2. 15.0 g agar are then added and the mixture is steamed. A solution of 20 g soluble starch in 100 ml distilled water and 18 ml 2% alkaline phenol red solution are added to the hot liquid and the mixture sterilized in an autoclave. After cooling to 55°C, 100 000 IU sodium penicillin G are added and the medium is poured into Petri dishes. The nutrient medium, incubated for 3 days at 25°C, is suitable for selective cultivation of *Pseudomonas* and *Aeromonas* spp., including *Ps. putrefaciens* from a Gram-negative microflora. IF

11 R 302

The effect of radiation on the microbial flora surviving radiation pasteurization of seafoods.

[Conference proceedings]

Sinnhuber, R. O.; Lee, J. S.

Atomic Energy Commission, USA Food Irradiation Contractors' Meeting 1968: 83-88 (1968) [7 ref.

En] [St. Univ., Corvallis, Oregon, USA]

Expt. were conducted to examine changes in a micro organism or microbial population brought about by irradiation, which might affect the





acceptability of the food. Radiation resistance and NaCl tolerance were investigated but no correlation was found. The effect of sodium benzoate on the retardation of the growth of microorganisms surviving radiation, and on the stimulation of *Salmonella* recovery was studied. Accelerated metabolic activity does not seem to be responsible for this effect. The proportion of antibiotic resistant species in ocean perch was reduced after a radiation dose of 0.1 Mrad. The roles of 2 *Achromobacter*, 3 *Pseudomonas* and 1 *Flavobacterium* species in fish deterioration were indicated. PEG

11 S 799

**Influence of temperature on some biochemical characteristics of *Pseudomonas* associated with spoilage of chicken.**

Rey, C. R.; Kraft, A. A.; Seals, R. G.; Bird, E. W.

*Journal of Food Science* 34 (3) 279-83 (1969) [25 ref. En] [Dept. of Food Technology, St. Univ., Ames, Iowa 50010, USA]

Studies were conducted with 4 cultures of *Pseudomonas* isolated from frozen chicken. Growth, survival and production of the green fluorescent pigment, pyoverdine, and extra-cellular proteinase and lipase activities were used as indices of the ability of pseudomonads to produce spoilage. The 4 isolates differed in their ability to perform the metabolic functions mentioned. The cultures were incubated at 15°, 5°, -18° and -29°C. Assays for proteolysis were made by means of a dye binding method; lipolysis was determined by titration of free fatty acids released from chicken fat, and a photofluorometer was used to measure fluorescent pigment. Growth was determined by colony count. At ≥0°C, survival was better and growth and enzyme activity were more extensive at 5° than at 15°C. Proteinase activity increased continuously, even when viable cells were decreasing; lipase production was correlated with growth. Formation of pyoverdine declined faster than did cell numbers. Survival of the cultures was better at -18° than at -29°C. Impairment of pyoverdine secretion was observed after exposure of the organisms to freezing temp., but the activity of the extracellular enzymes was not affected at <0°C. No marked differences were observed among cultures in rate of cell division, but max. populations, survival of organisms and stability of the proteolytic, lipolytic and fluorescent activities of the isolates were inversely related to biochemical activity above 0°C. AS

## VOLUME 2

01 P 129

**[Effect of storage temperature on the development of microflora in pasteurized milk; role of psychophilic bacteria.]**

Mourgues, R.; Auclair, J.

*Revue Laitière Française, 'l'Industrie Laitière'* 1969 (268) 505, 507, 509, 511, 513, 515, 519, 521, & 523 (1969) [21 ref. Fr, de, en] [Sta.

Centrale de Recherches Laitières et de Technologie

des Produits Animaux, INRA, 78-Jouy-en-Josas, France]

(i) 13 samples of commercial cartoned pasteurized milk and (ii) 13 samples of commercial high quality pasteurized milk here examined initially and after 4, 5, 6, 7 and 8 days storage in waterbaths at 4°, 6° and 8°C. Average total counts of (i) increased from 2520/ml initially to 3.02, 31.6 and 188 million/ml after 8 days at the 3 temp. respectively, and psychrotrophic counts increased from <42/ml to 6.95, 34 and 294 million/ml. Corresponding results for (ii) were an increase in total counts from 9350/ml to 31 200, 390 000 and 8 100 000/ml and an increase in psychrotrophic counts <2/ml to 14 500, 575 000 and 12 600 000/ml. Flavour defects occurred when the psychrotrophic count reached 2-120 million/ml. 93 of 115 strains isolated from plates made at the time flavour defects became evident, were identified as *Pseudomonas* spp. CDA

01 T 7

**Alanine production.**

Okumura, S.; Yoshingaga, F.; Yoshihara, Y. (Ajinomoto Co.)

United States Patent 3 463 704 (1969) [En]

L-Alanine is formed by enzymatic decarboxylation of L-aspartic acid employing *Pseudomonas* sp. No. 618 (ATCC No. 19 121). IFT

2 N 60

**[Hygiene and bacteriology of margarines.]**

Coignera-Devillers, L.

*Revue Française des Corps Gras* 16 (8-9) 561-71 (1969) [26 ref. Fr, en, de, es] [Lab. Cobac, Paris, France]

Although no hygienic and bacteriological problems are expected to emerge in modern margarine factories, these aspects must not be neglected. The tolerable bacteriological limits are <100 aerobes, <10 coliforms, <1 *Escherichia coli*, <200 yeasts, <2 moulds and <1 *Pseudomonas* in 1 g margarine. Possible sources of contamination, i.e. spores of *Aspergillus* spp., *Penicillium* sp., *Rhizopus* sp., *Petasporea* sp., *Paecilomyces* sp.: in the oils, contaminants in the water and air, and those originating from insects, rodents, and humans are to be examined regularly. Hygienic and bacteriological checks are described. IF

2 R 41

**Microbiological evaluation of Pacific shrimp processing.**

Harrison, J. M.; Lee, J. S.

*Applied Microbiology* 18 (2) 188-92 (1969) [16 ref. En] [Dept. of Food Sci. and Technology, St. Univ., Corvallis, Oregon 97331, USA]

Samples were collected from five processing points at 2 plants (X and Y). The initial counts on raw shrimp (*Pandalus jordani*) ranged from  $1.3 \times 10^6$  to  $3.0 \times 10^6$  the flora comprising, in order of importance *Acinetobacter*, *Moraxella*, *Flavobacterium*, *Pseudomonas*, Gram positive cocci and *Bacillus* spp. No yeasts were isolated. Both numbers and type of bacteria were affected by differences in processing. Peeling and sorting increased microbial numbers while cooking,





washing and brining decreased them. Only Gram positive cocci and *Acinetobacter-Moraxella* survived heating, the proportion of Gram positive cocci increasing after hand sorting. Brining increased the proportion of Gram positive cocci (Plant X), whereas washing reduced the proportion (Plant Y). Final counts ranged from  $3.0 \times 10^3$  to  $9.0 \times 10^4$  with 76% of the flora being Gram positive cocci in Plant X and 33.3% in Plant Y. *Acinetobacter-Moraxella* contributed 8% and 55.6% respectively. Most Gram positive cocci isolated were coagulase negative. Washing or brining after human handling is recommended to improve microbiological quality. AHV

## 2 S 93

**A microbiological examination of muscle tissue of beef, pork, and lamb carcasses.**

Vanderzant, C.; Nickelson, R.

*Journal of Milk and Food Technology* 32 (9) 357-61 (1969) [36 ref. En] [Animal Sci. Dept., Texas A & M Univ., College Station 77843, USA]

Microbiological examination of the muscle tissue (biceps femoris) of 11 beef, 12 pork and (vastus lateralis) of 11 lamb carcasses was carried out shortly after slaughter and after 3 days storage at 1°C. A majority of samples yielded no isolates on bloor agar plates. The microbial types isolated included: *Staphylococcus*, *Micrococcus*, *Sarcina*, *Streptococcus*, coryneforms, *Bacillus*, *Clostridium*, *Flavobacterium*, *Pseudomonas*, *Moraxella*, *Alcaligenes*, *Acinetobacter anitratum* (Herellea), and yeasts and moulds. *Staphylococci* predominated, being found in 5 of the 12 pork, 4 of the 11 lamb and 3 of the 11 beef samples, and a high % of them were coagulase-positive. Coryneforms also predominated in beef and lamb samples. More bacterial isolates were found in warm muscle than chilled samples. No psychrophilic bacteria were recovered. Diagrammatic schemes of identification of Gram-positive, and Gram-negative oxidase positive or negative bacteria are given. AL

## 3 P 295

**Milk gel composition.**

Shuppner, H. R., Jr. (Kelco Co.)

Canadian Patent 824 635 (1969) [En]

Milk gelling compositions comprise mixtures of tetra-alkali metal pyrophosphate, edible calcium salts, *Xanthomonas hydrophilic* colloid and locust bean gum. IFT

## 3 Q 30

**The effect of ionizing radiation on selected chemical, physical and microbiological characteristics of egg white proteins.**

Mohamed, S. Y.

Dissertation Abstracts International. Section B. The Sciences and Engineering 30 (3) 915 (1969) [En] [The A & M Univ., College Station, Texas, USA]

The effect of 0.850 Mrad gamma radiation on some chemical, physical and microbiological characteristics of purified solutions of 0.5% lysozyme, 1.0% ovalbumin and 1.0% conalbumin extracted from egg albumin was studied. No major changes in density, viscosity or pH were found. Growth rates of 2 strains of *Pseudomonas fluorescens* isolated from milk and eggs were lower than on non-irradiated control substrates, but this effect was reversed during 3 wk post-radiation frozen storage. The 4 reactive sulphhydryl groups in ovalbumin were reduced to 3 and a positive relation was found between the number of such groups and growth of P.

*fluorescens* on ovalbumin substrate. A slight increase was found in the Fe binding activity of conalbumin, although a freezing and thawing procedure decreased this by ~25%. However, Fe binding increased in both radiated and control samples during 3 wk frozen storage. ELC

## 4 B 28

**Influence of conditions of rehydration on the enumeration of bacteria from freeze-dehydrated model food systems.**

Vanderzant, C.; Hyder, K.

*Journal of Milk and Food Technology* 32 (10) 390-93 (1969) [21 ref. En] [Animal Sci. Dept., A&M Univ., College Station, Texas 77843, USA]

The number of surviving bacteria in rehydrated freeze-dried model food systems depended on the composition of the material in which the bacteria were freeze-dried, the composition, temp. and vol. of the rehydration medium, and the rate of rehydration. Model systems consisted of sterile solutions of 2% gelatine, 2% gelatine + 6% glucose, and skim-milk. These were inoculated with *Pseudomonas fluorescens*, *Escherichia coli*, *Alcaligenes faecalis*, *Serratia marcescens*, *Microbacterium lacticum* and *Arthrobacter globiformis*, dehydrated to a residual moisture content of <3% of the initial content and then rehydrated in distilled water, 1% peptone or 1% tryptone. The number of viable cells remaining was determined on pour-plates of trypticase soya agar + 0.5% (w/v) yeast extract. Highest counts were obtained when model systems were rehydrated at 25°C with a vol. of distilled water





equal to that removed during dehydration and at a rate of  $10^{-1}$  mg  $H_2O$ /sec/mg dry material. The number of survivors was highest in skim-milk and lowest in gelatine for all species, whereas addition of peptone or tryptone to the rehydration medium of gelatine-glucose systems increased the counts of *Ps. fluorescens* and *S. marcescens* only. It can be expected that a certain amount of interaction occurs among the factors affecting the number of bacterial survivors in freeze-dehydrated foods. SAH

#### 4 L 215

[Slime forming bacteria in sugar manufacture] Über Polysaccharidbildner in der Zuckerfabrikation. Schneider, F.; Hoffmann-Walbeck, H. P.; Abdou, M. A. F.

Zucker 22 (17) 465-72 (1969) [52 ref. De, en, fr]

Rod-shaped fluorescent strains of bacteria which produce levan have been isolated from intact beet tissue and frost damaged beets. Due to difficulties of identification of such organisms a large number of diagnostic tests have been carried out to determine their morphological, cytological, physiological and biochemical characteristics. All the strains tested showed saccharolytic, proteolytic and lipolytic activity and belonged to biotype B of *Pseudomonas fluorescens*. The authors discuss some properties of taxonomical significance and others which are of importance to the sugar industry. The problem of pathogenic and non pathogenic spp. classified under the genus *Pseudomonas* is discussed. IN

#### 4 P 421

Comparison of milk proteolysis by *Bacillus subtilis* protease and by *Pseudomonas fluorescens*. Fish, N. L.; Pinkston, P. J.; Claydon, T. J. Journal of Dairy Science 52 (12) 2039-41 (1969) [5 Univ., Manhattan, Kansas 66502, USA] ref. En] [Dept. of Dairy and Poultry Sci., St. Univ., Manhattan, Kansas 66502, USA]

In preliminary tests using a ninhydrin method as a measure of protein breakdown, proteolysis of milk by a *Bacillus subtilis* enzyme appeared to differ from that by *Pseudomonas fluorescens*. Further study showed that with *Ps. fluorescens*, ninhydrin values were higher than with the *B. subtilis* enzyme at comparable non-protein nitrogen levels, and the differences became greater as non-protein nitrogen increased. The linear trend for the relationship between ninhydrin value and non-protein nitrogen was closer for *Ps. fluorescens* than for *B. subtilis* enzyme. Although absorbancy patterns (at 280 nm) from fractionation on G-25 Sephadex were basically similar, there were several differences. Due to differences in the breakdown products formed in the 2 hydrolysates, the ninhydrin method used was not a satisfactory index of protein digestion by the *B. subtilis* enzyme. [See also FSTA (1969) 1 8P731 & J. Dairy Sci. (1967) 50 (2) 172-76.] AS

#### 4 P 432

Ester production by *Pseudomonas fragi*. II. Factors influencing ester levels in milk cultures.

Reddy, M. C.; Bills, D. D.; Lindsay, R. C. Applied Microbiology 17 (6) 779-82 (1969) [8 ref. En] [Dept. of Food Sci. and Technology, St. Univ., Corvallis, Oregon 97331, USA]

Production of (i) ethyl butyrate and (ii) ethyl hexanoate by 2 strains of *Ps. fragi* grown at 21°C in homogenized milk (3.6% fat) and reconstituted skim-milk (<0.1% fat), was measured by gas-liquid chromatography. Ester production and cell counts were higher when 0.2% ethanol was added to the milk medium. When 0.25% butyric acid + 0.2% ethanol was added, production of (i) increased slightly and cell count decreased slightly. Mean concn. of esters produced in milk, milk + ethanol, and milk + ethanol + butyric acid respectively, were (ppm): in homogenized milk, (i) 0.02, 0.34 and 0.50, and (ii) <0.01, 0.20 and 0.90; in reconstituted skim-milk, (i) 0.04, 0.45 and 0.37, and (ii) <0.01 0.10 and 0.12. Aeration of any of the media during incubation reduced the cell population slightly. A relationship was observed between increase in cell count and increase in ester production. [See J. Dairy Sci. (1968) 15 (5) 656-59 & FSTA (1969) 1 12P1244 for parts I & III respectively.] CDA

#### 4 P 518

Microflora of Cheddar cheese and its influence on cheese flavour. [A review]

Fryer, T. F.

Dairy Science Abstracts 31 (9) 471-90 (1969)

[Numerous ref. En] [Nat. Inst. for Res. in Dairying, Shinfield, Reading RG2 9AT, England]

#### 4 R 139

Studies on bacteriophages of psychrophilic fish spoilage bacteria.

Delisle, A. L.

Dissertation Abstracts International. Section B. The Sciences and Engineering 30 (2) 754-55 (1969) [En] [Univ., Amherst, Massachusetts, USA]

180 phages active against psychrophilic fish spoilage bacteria were isolated from sewage, fish pier water and haddock fillets. Most formed plaques at 2°C or 20°C and attacked either marine or terrestrial forms. Most were not strain or species specific and the lack of specificity precludes their use for phage typing psychrophilic pseudomonads or for differentiating between marine and terrestrial types. Phages for *Pseudomonas putrefaciens* however show considerable species specificity and phage typing appears feasible. *P. putrefaciens* phages may be both facultatively or obligately psychrophilic. Temperature influences burst size and latent period and in some cases the efficiency of plating, adsorption and host-controlled modification and restriction. AHV

#### 4 R 140

Effect of EDTA treatment on spoilage characteristics of petrale sole and ocean perch fillets.





Pelroy, G. A.; Seman, J. P.

Journal of the Fisheries Research Board of Canada 26 (10) 2651-57 (1969) [11 ref. En] [Bureau of Commercial Fisheries, Technological Lab., Seattle, Washington 98102, USA.]

Work carried out to determine the effect of disodium, tetrasodium and disodium calcium salts of EDTA on the storage properties of these fish is described with experimental details. Spoilage in vacuum packed fish was also examined and the results are given. Shelf-life in the presence of EDTA was increased as growth of *Pseudomonas* was inhibited. RPC

4 S 284

[Bacteriological and organoleptic changes in frozen broilers and pullets during storage between -2.5 and -10°C.] Mikrobielle und sensorische Veränderungen gefrorener Brathähnchen und Poularde bei Lagerung im Temperaturbereich von -2,5 bis -10°C.

Schmidt-Lorenz, W.; Gutschmidt, J.  
Fleischwirtschaft 49 (8) 1033-38 & 1041 (1969) [12 ref. De, en, fr, es it] [Botanisches Inst., Univ., Karlsruhe 7500, W. Germany]

Frozen broilers and pullets were packaged in Cryovac shrink film. The microbiological and organoleptic changes occurring in them during storage at -2.5°, -5°, -7.5°, and -10°C and for reference at -30° and 0°C were investigated. The flora in poultry frozen at -30°C for 2 wk was made up of 30% Gram-positive spp. (*Corynebacterium*, *Brevibacterium*, *Lactobacilli*, *Micrococci*, *Gaffkya* spp.) and 70% Gram-negative spp. (*Pseudomonads*, *Aeromonads*, *Vibrio* spp.) and a few yeasts. After storage for 57 wk at -30°C the number of bacteria was reduced by ~60%, the flora then consisting of 70% Gram-positive and 30% Gram-negative bacteria. At storage temp. of -2.5 to -10°C bacterial counts at first showed a decline, but after a certain (temp. dependent) time rose again. With storage at -2.5°C, the bacteria grew for 2-3 wk, but the yeasts predominated. After ~4 wk at -5°C, growth of the Gram-positive group occurred only in the beginning, the main flora consisting of yeasts. At -7.5 and -10°C, only yeast and mould growth was observed. Comparison of organoleptic changes with the microbial growth between 0° and -7.5°C indicated that these changes were induced by micro-organisms. It is recommended that broilers and pullets should not be stored at temp. above -10°C.

FWJ

4 S 331

Development of the bacteriological spoilage flora of lamb - results of some laboratory experiments using minced lamb and lamb chops.

Patterson, J. T.  
Record of Agricultural Research 18 (1) 9-13 (1970) [11 ref. En] [Agric. Bacteriology Res. Division, Ministry of Agric., Belfast, Northern Ireland]

Lab. expt. are described where the initial flora and the flora which developed during storage at 4 and 15°C was studied using minced lamb and lamb chops. The initial flora consisted of Gram-positive rods, Gram-negative rods and Gram-positive cocci. Spoilage at 4°C was due mainly to

organisms of the *Pseudomonas*-*Achromobacter* group while at 15°C a more varied flora of Gram-positive and Gram-negative rods was responsible. Spoilage was evident when the total number of bacteria/g of meat or per cm<sup>2</sup> meat surface was of the order 10<sup>8</sup>-

10<sup>9</sup>. The use of a chlorine dip with 20 ppm free residual Cl<sub>2</sub> lowered the initial count by ~70% on the chops. Such treatment had no noticeable effect on the type of organism causing spoilage. AS

5 P 562

A method for the detection of weak lipolysis of dairy lactic acid bacteria on double-layered agar plates.

Umemoto, Y.

Agricultural and Biological Chemistry 33 (11) 1651-53 (1969) [9 ref. En] [Lab. of Food Chem. and Technology, Univ., Nagoya, Japan]

In this method, 1 ml diluted culture and 15 ml nutrient agar (2% glucose, 1.5% peptone, 0.5% NaCl, 0.3% yeast extract, 1.9% agar and 1 ml Tween 80 and 100 ml tomato juice/l.; pH 6.6) is poured onto a base layer of 1.5% agar and 5% stained olive oil (30 g olive oil stained with 50 ml aqueous solution, 1 : 1500, of Victoria and/or Nile blue, taking care to remove all free pigment) and incubated at 30° or 37°C for 5-7 days. Lipolysis is shown by clear, pale or slight blue colour on, around or below colonies. The following 15 bacterial strains examined all had lipolytic activity and gave more distinct colour changes than in earlier tests: *Lactobacillus casei* L-7 and L-14, *L. helveticus* L-53, *L. plantarum* L-34, *Streptococcus lactis* 527, *Str. faecalis* S-f, *Leuconostoc citrovorum* F-22, *Pseudomonas fluorescens* B-33, *Ps. aeruginosa*, *Staphylococcus aureus* 209 p, Y3Y-8 (*Bacillus*), HL-1 (coccus) HL-9 (coccus). Distinct lipolysis was shown to be present in *Str. lactis* and *Str. cremoris*, weak lipolysis in *Str. faecalis* and in unidentified bacteria from Cheddar cheese and starter culture. Use of both pigments was recommended for detecting weak lipolysis. RM

5 S 346

Effect of the gaseous environment on the growth on meat of some food poisoning and food spoilage organisms.

Shaw, M. K.; Nicol, D. J.

Proceedings of the European Meeting of Meat Research Workers 15: 226-32; (summ. III) 55-56 (1969) [20 ref. En, de, ru] [CSIRO Meat Res. Lab., Queensland, Australia]

Growth of a non-pigmented strain of *Pseudomonas* (1482) on muscle slices at 5°C was not inhibited over the range 0.8-100% environmental O<sub>2</sub> concn. Growth rate at 0.2% was 1/4 of that in the air, and no growth occurred in the absence of O<sub>2</sub>. A psychrophilic strain of *Microbacterium* (22) grew at a constant rate over the range 0.2-100% O<sub>2</sub> but did not give sustained growth in the absence of O<sub>2</sub>. A psychrophilic Gram-positive, catalase-negative, lactic acid-producing isolate (58) grew independently of the O<sub>2</sub> concn. *Pseudomonas* 1482 was inhibited by 10% CO<sub>2</sub> and inhibition was independent of O<sub>2</sub> concn. above 1%





O<sub>2</sub>. *Microbacterium* 22 and isolate 58 were not inhibited by 10% CO<sub>2</sub>. *Escherichia coli* and *Salmonella oranienburg* grew at identical rates on meat slices over the temp. range 8-37°C. No growth, but some filament formation occurred at 7°C. Increased CO<sub>2</sub> concn. and decreased O<sub>2</sub> concn. caused some inhibition of growth; CO<sub>2</sub> inhibition was again independent of O<sub>2</sub> concn. over a range 0.6-18.7% O<sub>2</sub>. These results are discussed in terms of meat packaging, meat ageing, and use of *E. coli* as indicator of *Salmonella* growth. AS

6 H 738

Foam.

Anon.

International Brewers' Journal 106 (1253) 73-75 (1970) [En, de, fr]

Lack of fundamental knowledge of foam stability has led to the use of foam improvers such as Co, polyethylene oxides (which decrease bubble size at levels of 40-160 ppm but block filters and inhibit gas release), phosphorylated mannan at 20-80 ppm, and a synthetic polysaccharide to be used in conjunction with a synthetic gum and corn syrup. Adhesion of foam to glass may be effected by the use of a polysaccharide produced by *Xanthomonas campestris* or by Zn associated with gum arabic or propylene glycol alginate. PEG

6 J 562

[Comparative investigations of the antibacterial effect of various leek and cruciferous plants.]

Vergleichende Untersuchungen über die antibakterielle Wirksamkeit verschiedener Lauchgewächse und Cruciferen-Arten.

Rudat, K.-D.

Qualitas Plantarum et Materiae Vegetabiles 18 (1-3) 29-43 (1969) [De, en, fr] [Zentrallab., St.

Markus-Krankenhaus, Frankfurt/Main, W. Germany]

Onion juice showed weak but nasturtium (*Tropaeolum majus*) and garlic showed strong inhibiting effect on various test organisms, including *Streptococcus pyogenes* A, *Streptococcus salivarius*, enterococci, *Streptococcus aureus*, *Bacillus pseudoanthracis*, *Bacillus subtilis*, *Salmonella typhosa* and paratyphi, *Escherichia coli*, *Pseudomonas aeruginosa* and *Proteus vulgaris*. Juices from black and white radishes, leeks and chives also showed antibacterial properties. IF

6 Q 69

Growth characteristics of *Pseudomonas fluorescens* on conalbumin and lysozyme substrates.

Gardner, F. A.; Nikoopour, H.

Poultry Science 48 (1) 43-48 (1969) [8 ref. En]

[Dept. of Poultry Sci., A&M Univ., College Station, Texas 77840, USA]

The growth behaviour of *Ps. fluorescens* on conalbumin and lysozyme substrates containing 1.0% protein and adjusted to pH 7.5 was investigated. Growth and fluorescence production on conalbumin substrates proceeded rapidly and reached a max. level during the first few days of incubation. A unique growth pattern was obtained when *Ps.*

*fluorescens* was grown on 1% lysozyme. During the 1st wk of incubation, a prolonged and severe lag phase accompanied by a 96% reduction in the initial bacterial population was observed, followed by a sharp increase in bacterial numbers during the 2nd wk. Results obtained suggest an alteration in the growth characteristics of the test organisms or a substrate induced selection of organisms within the test strain which were resistant to lysozyme activity. Growth support characteristics of the substrate were not altered during incubation. Fluorescence production, negligible during the first few days, increased rapidly during the 2nd wk. The fluorescent pigment was bright blue in contrast to bright green on conalbumin substrates. [See also FSTA (1969) 1 9B329.] AS

6 R 200

Inhibition of *Pseudomonas* species by hydrogen peroxide producing lactobacilli [from seafoods and other marine source].

Price, R. J.; Lee, J. S.

Journal of Milk and Food Technology 33 (1) 13-18 (1970) [37 ref. En] [Dept. of Food Sci. and Technology, St. Univ., Corvallis, Oregon 97331, USA]

81 microbial species isolated from seafoods and other marine sources were examined to determine the extent of interactions among these species. Spot-plates, cross-plates, and concurrent growth experiments at 7, 15, 20, and 30°C indicated that *Lactobacillus* spp. were capable of inhibiting other micro-organisms. *Lactobacillus* spp. isolated from oysters and identified as *L. plantarum* produced a substance inhibitory to *Pseudomonas*, *Bacillus*, and *Proteus* spp., the most sensitive being *Pseudomonas*. The inhibitory substance accumulated in *Lactobacillus* culture media, reaching max. concn. in 4 to 5 days at 30°C. The active substance was dialysable, heat labile, and inactivated by catalase. Inhibitor production paralleled H<sub>2</sub>O<sub>2</sub> formation in *Lactobacillus* cultures, further indicating that the observed inhibition resulted from H<sub>2</sub>O<sub>2</sub> produced by lactobacilli. These findings may explain the abnormal shifts in microbial flora observed in foods where *Lactobacillus* spp. have outgrown the natural flora. AS

6 S 491

[Partial softening of sausages caused by *Pseudomonas fluorescens*.] Partielle Erweichung von Würstchen durch Befall mit *Pseudomonas fluorescens*.

Zeller, M.

Archiv für Lebensmittelhygiene 20 (9) 206-09

(1969) [16 ref. De] [Staatliches Tierärztliches Untersuchungsamt, Stuttgart, W. Germany]

Wieners in vacuum packs or in cans were submitted by the manufacturers to the State Vet. Control Lab. in Stuttgart for examination because of customer complaints about softening at the end. It was established that the fault was due to proliferation of *Pseudomonas fluorescens* in the affected parts and that infection occurred before packaging through immersion in contaminated cooling water. SKK





7 B 50

[Application of steady state conduction system to microbiology. VI. Temperature relations for growth of low temperature bacteria incubated under a temperature gradient and its significance.]

Nakae, T.

Journal of the Agricultural Chemical Society of Japan 42 (10) 639-44 (1968) [16 ref. Ja, en]  
[Coll. of Agric., Univ., Okayama, Japan]

96 strains of low temp. bacteria were isolated from animal food products such as milk, ice cream, beef, pork, mutton, fowl, ham, sausage and egg. Most of the strains isolated were Gram-negative rods, including *Pseudomonas*, *Alcaligenes* and *Achromobacter*, while *Micrococcus* was the dominant Gram-positive sp. Optimum, max. and min. growth temp. and lethal incubation temp. when incubated for 24 h were determined from temp. gradient incubation. The optimum growth temp. ranged mostly from 26 to 32°C, and the min. growth temp. from 11 to 15°C. Most of the strains tested were psychrotrophic mesophiles and there were no typical sychrophilic bacteria. MY

7 C 173

Integrity of the microbial cell wall against surface active agents.

Soprey, P. R.

Dissertation Abstracts Internationil. Section B. The Sciences and Engineering 30 (4) 1814-15 (1969)  
[En] [Univ., Lincoln, Nebraska 68508, USA]

The development of tolerance of *Escherichia coli*, *Pseudomonas fluorescens*, *Streptococcus faecalis* and *Str. lactis* to quaternary ammonium compounds (QAC) was studied. *E. coli*, *Ps. fluorescens*, and *Str. lactis*, in sub-lethal concn. of QAC, showed tolerance increases of 6-fold (to 28.0 µg/ml) in 12-14 days, 5-fold (from 12.0 to 60.0 µg/ml) in 9 days and 14-fold (from 0.1 to 1.4 µg/ml) in 24 days, respectively. The changes induced in the bacterial cultures were investigated by studying the adsorption of radioactive QAC, and susceptibility to bacteriophages. The results indicated a modification of the bacterial cell surfaces during tolerance acquisition. It is stated that the possibility of microflora from food handling equipment acquiring tolerance is negligible. HSi

7 L 420

[Polysaccharide-forming bacteria in sugar manufacture.] Über Polysaccharidbildner in der Zuckerfabrikation.

Schneider, F.; Hoffmann-Walbeck, H. P.;

Abdou, M. A. F.

Zucker 22 (20) 561-66 (1969) [21 ref. De, en, fr]

A general description is given of the polysaccharide-forming bacteria which occur in bacterially contaminated sugar beets, viz. *Leuconostoc mesenteroides*, *Corynebacterium beticola* and *Pseudomonas fluorescens*, biotype B. Physiological and biochemical properties of *Corynebacterium beticola*, a new phytopathogenic, saccharolytic, laevan-producing organism, are also described. A simple method of differentiating between the 3 spp. is included. IN

7 P 829

[Bacteriological examination of milk from mastitis-infected quarters.]

Uchimura, H.; Tokita, F.

Japanese Journal of Dairy Science 18 (6) A170-75 (1969) [20 ref. Ja, en] [Faculty of Agric., Shinshu Univ., Ina, Nagano, Japan]

Counts of micro-organisms in mastitis milk collected from a district in Nagano, were of the order  $10^6$ - $10^7$ /ml, and the predominant species were *Micrococcus luteus*, *Brevibacterium fulvum*, *Bacillus cereus* and *Pseudomonas aeruginosa*. *Brev. fulvum* was considered to be a newly-detected species from mastitis milk. *Brev. fulvum*, *B. cereus* and *Ps. aeruginosa* reduced the casein number in skim-milk from 78.5 to 54.5, 33.3 and 40.1 respectively after 96 h. All strains hydrolysed ovalbumin, with optimum activity at neutral or slightly alkaline pH; *M. luteus* and *Brev. fulvum* showed higher proteolytic activity than the other 2 organisms. [From En summ.] CDA

7 P 879

Formation and final composition of the bacterial flora of a dairy waste activated sludge.

Adamse, A. D.

Water Research 2: 665-71 (1968) [12 ref. En]

[Lab. of Microbiology, Agric. Univ., Wageningen, The Netherlands]

Development of the bacterial flora was similar to that obtained in an oxidation ditch in expt. in which an artificial dairy waste containing 1 g/l. of a 3:1 mixture of dried whey and dried skim-milk was added in increasing quantities to tap water seeded with sewage and treated in lab. apparatus. Initially, *Pseudomonadaceae* were present in large numbers, but after 56 days fill-and-draw treatment with increasing BOD loads *Arthrobacter*-like *Corynebacteriaceae* were the dominant organisms, followed by *Achromobacteriaceae*. Changes in the physiological characteristics of the total activated sludge flora included a reduction in the number of organisms having proteolytic activity and in those producing an acid or alkaline reaction in the Hugh and Leifson test. BOD reduction was 90.9% of the 250 ppm load after the apparatus had been in operation ~60 days. BEPC

7 P 930

Microbial flavour defects in dairy products and methods for their simulation. II. Fruity flavour.

Morgan, M. E.

Journal of Dairy Science 53 (3) 273-75 (1970) [17 ref. En]

The history, nomenclature and the mechanism involved in the development of the fruity defect caused by the metabolism of *Pseudomonas fragi* in dairy products are briefly reviewed. A flavour reference standard suitable for training judges of dairy products in recognition of this defect may be prepared by culturing an active strain of the organism in pasteurized homogenized milk fortified with 0.1% ethanol. This defect may be





more conveniently simulated in milk by addition of a mixture of pure ethyl butyrate and ethyl hexanoate in 1,2-propanediol to give concn. of 0.35 and 0.50 ppm of the respective esters. The same ester mixture may also be used in simulation of the fruity defect in Cottage cheese samples. AS

## 7 T 237

[Guanylic and xanthylic acid production.]

Kikkoman Shoyu Co. Ltd.

Japanese Patent 952/70 (1970) [Ja]

5'-guanylic acid and 5'-xanthylic acid are produced by phosphorylating guanosine or xanthosine with *Pseudomonas ovalis* H-65. IFT

## 8 G 312

[Investigations on the production of unicellular proteins from hydrocarbons.]

Balatti, A. P.; Mazza, L. A.; Segovia, R. F.;

Ertola, J.

Ion (Madrid) 30 (342) 5-13 & 16 (1970) [21 ref.

Es] [Facultad de Sci., Univ. Nacional, 47 and 115, La Plata, Argentina]

The production of microbial protein from hydrocarbon substrates was studied using strains of *Micrococcus cerificans* and *Pseudomonas aeruginosa* (NCTC 5940) grown on an inorganic medium ( $\text{NaCl}$ ,  $(\text{NH}_4)_2\text{SO}_4$ ,  $\text{MgSO}_4$ ,  $\text{KH}_2\text{PO}_4$ ,  $\text{FeCl}_3$ ) with (i) pure hydrocarbons from n-decane up to n-eicosane and (ii) heavy gas oil as C source in expt. fermentation units of 7.5 l. and a pilot plant of 40 l. capacity. Growth was determined by the amount of alkali required to maintain pH or by the utilization of N source, both directly related to the concn. of cells (dry wt.) as determined gravimetrically. Optimal growth occurred on n-hexadecane and n-octadecane, with growth constants of  $0.37 \text{ h}^{-1}$  on tetra-, 0.88 on hexa- and 0.93 on octa-decane. Growth on gas oil or crude petroleum was much slower but had the additional advantage of removing normal paraffins

from the oil. Efficiency of conversion of hydrocarbons into cellular material was 85% for pure hydrocarbons, and 10-11% for gas oil (60% when recalculated with respect to paraffins.) With *P. aeruginosa* on octadecane, 81% of C and 87-90% of N was accounted for. Composition of cellular material of *Micrococcus* on both substrates was similar, and amino acid composition agreed with results obtained by FAO and the Esso Co. Biological value (BV) was comparable with casein (70.0) on hexadecane (67.0), but fell to 36.0 on gas oil and when fed to animals was accompanied by degeneration of the liver, thought to be due to toxic oil residues: washing cells with petrol ether or chloroform produced no improvement, but 24 h Soxhlet extraction with petrol ether restored BV to 63.0. Problems of comparative cost and utilization of bacterial proteins as a dietary supplement or for animal nutrition are discussed. RM

## 8 P 955

[Some characteristics of bacteria with inhibitory activity isolated from milk.]

Maida, B.; Stinchi, S.; Montelli, P.

Industrie Alimentari 9 (1) 65-67 (1970) [7 ref. It, en] [Centrale del Latte, Rome, Italy]

6 organisms of the *Streptococcus lactis* group and 1 of *Pseudomonas aeruginosa*, isolated from milks delivered to the Central Milk Plant in Rome, possessed inhibitory activity against *Bacillus stearothermophilus*, *B. cereus*, *B. subtilis*, *Sarcina lutea* and *Staph. aureus*. As this activity is not destroyed by treatment with penicillinase, and is also operative, for certain *Str. lactis* strains, against nisin-resistant *B. subtilis*, it does not appear to be based on production of nisin-type inhibitors. The possible influence of bacterial inhibitors on the quality of milk and milk products is briefly discussed. GTP

## 8 P 1127

[Microbial proteases and lipases in cheese ripening.]

Carini, S.

Latte 43 (3) 183-89 (1969) [11 ref. It, en]

[Istituto di Industrie Agrarie, Univ., Milan, Italy]

The effect was studied of pH and temp. on the lipase and protease activities of disintegrated cells of *Streptococcus bovis*, *Str. thermophilus* (4 strains), *Str. lactis* (2 strains), *Str. diacetylactis*, *Str. casei*, *Str. cremoris*, *Str. faecalis* (2 strains), *Lactobacillus lactis* (2 strains), *L. helveticus*, *L. acidophilus*, *L. bulgaricus*, *L. jugurti*, *L. rhamnosus*, *Micrococcus freudenreichii* (2 strains), *M. caseolyticus*, *M. conglomeratus*, *M. candidus*, *Micrococcus* spp. (6 strains), and *Pseudomonas fluorescens*. Protease activity was estimated on casein by the increase in optical density at 275 nm of a trichloroacetic acid filtrate; lipase activity was estimated on tributyrin agar. Protease activity at 30°C was greatest at pH 4 and 5 but was still high at pH 6 for most strains; the optimum temp. at pH 7 was 30-40°C but the activity was high over the range 15-55°C. For the lipases of streptococci and lactobacilli the optima were usually pH 8 and 15-30°C, but the micrococcal lipase activity was generally higher at pH 7 and at 45°C. [See also FSTA (1969) 1 10B332.] JMD

## 8 S 705

[Investigations into a new method of chilling poultry. III. Hygienic aspects of the process.]

Untersuchungen über ein neues Kühlverfahren für Schlachtgeflügel. III. Hygienische Überprüfung des Verfahrens.

Scholtyssek, S.; Heimbach, P.; Berner, H.

Fleischwirtschaft 49 (12) 1617-20 & 1623 (1969)

[18 ref. De, en, fr]

Broilers were scalded at either 50-52°C or 57-58°C, then chilled in a stream of cold air (i), in a spin chiller (ii) or by a combined method (iii). They were stored at -1°C and the development of microbial flora on the skin was investigated quantitatively and qualitatively. Broilers chilled by (i) showed no significant





rise in bacterial count until 16 days storage, while the count on the breast skin of broilers chilled by (ii) or (iii) increased after 3-7 days. This earlier rise in bacterial count be correlated with a higher % of cold tolerant, Gram-negative bacteria (*Pseudomonas*, *Klebsiella*, *Enterobacter*, *Serratia*) in the initial flora. Bacteriological investigations and sensory tests proved that broilers chilled by (i) retained an acceptable quality for ~14-20 days, those chilled by (ii) and (iii) for 7-14 days. The first sensory signs of spoilage appeared with counts of  $10^7/\text{cm}^2$ .

Bacterial counts from broilers scalded at 57-58°C were slightly higher than for broilers scalded at 50-52°C, and spoilage began somewhat earlier, but this difference was of minor importance compared to the effect of the chilling methods. FWJ

#### 8 S 728

##### Spoilage potential of the microflora of dehydrated

##### raw beef.

Silverman, G. J.; Cohen, M. K.  
Bacteriological Proceedings 1970: 13 (1970) [En]  
[US Army Lab., Natick, Massachusetts, USA]

This study was concerned with the max. recovery of micro-organisms, their identification, and the characterization of those metabolic activities capable of causing food spoilage. Max. recovery of cells was obtained by rehydrating the dried beef with trypticase soy (TS) broth at 20°C and recovering the microflora on TS agar supplemented with yeast extract and 5% horse blood at 20°C. The increased recovery due to blood (15-30%) most noticeably enhanced the recovery of the *Moraxella*-*Acinetobacter* group. The flora was extremely diverse, and numerical taxonomy was employed for identification. The major survivors of freeze-drying consisted of gram-positive staphylococci-micrococci (21%), streptococci (8%), *Microbacterium* (11%), *Corynebacterium* (3%), and *Brevibacterium* (17%). The gram-negative rods consisted of *Moraxella*-*Acinetobacter* (36%), *Pseudomonas* (4%), and *Cytophaga* (1%). The taxonomic classification of a number of genera, especially *Microbacterium*, *Corynebacterium*, and *Moraxella* was unsatisfactory. Only a portion of the microflora possessed the combination of metabolic activities with ability to grow at refrigeration temp. (0-5°C) necessary for them to cause one or more types of low-temp. food spoilage. AS

#### 9 S 831

##### Inhibitory effect of *Pseudomonas* on selected *Salmonella* and bacteria isolated from poultry.

Oblinger, J. L.; Kraft, A. A.  
Journal of Food Science 35 (1) 30-32 (1970) [10 ref. En] [Dept. of Food Technology, St. Univ., Ames, Iowa 50010, USA]

A perpendicular streak technique was used as a preliminary screening procedure to determine relative degrees of inhibition exhibited by known strains of *Pseudomonas* against sensitive *Salmonella* and known organisms isolated from poultry. Spectrophotometric analysis was also used to measure inhibitory activity produced by

cultures against sensitive organisms. The production of pigment appeared to be closely linked to the relative ability of different *Pseudomonas* cultures to produce inhibition. *Pseudomonas* strains were inhibitory to strains of *Salmonella*, *Staphylococcus*, *Escherichia coli*, and *Streptococcus*. None of the inhibition producing strains of *Pseudomonas* isolated from poultry were mutually repressive. IFT

#### 9 T 331

##### Ethionine-induced porphyrin synthesis by *Pseudomonas denitrificans*.

White, R. F.; Demain, A. L.  
Bacteriological Proceedings 1970: 4 (1970) [En]  
[Merck Sharp & Dohme Res. Lab., Rahway, New Jersey, USA]

The effect of L-ethionine, a methionine analogue, on the production of vitamin B<sub>12</sub> by *Ps. denitrificans* was studied. L-Ethionine, when added to a synthetic medium at 0.6 mM, resulted in the production of a deep-red pigment which did not satisfy the vitamin B<sub>12</sub> requirement of the assay organism. Standard isolation procedures yielded a compound chromatographically and spectroscopically identical to authentic coproporphyrin III. This porphyrin was synthesized at the expense of vitamin B<sub>12</sub> biosynthesis and at a rate of 1 µg/ml/h to a final concn. of 35 µg/ml. The growth of *Ps. denitrificans*, as well as other fermentation parameters, was not appreciably altered by the addition of L-ethionine. Betaine, which has been shown to exhibit a regulatory control on vitamin B<sub>12</sub> biosynthesis, also was found to be an obligatory medium constituent in L-ethionine-inducible coproporphyrin III accumulation. It is concluded that betaine has a regulatory control, in an enzymatic step prior to the porphyrin-vitamin B<sub>12</sub> branch, in the biosynthetic pathway of *Ps. denitrificans*. AS

#### 9 T 332

##### Nature of the stimulatory effect of betaine on the vitamin B<sub>12</sub> fermentation.

White, R. F.; Demain, A. L.  
Bacteriological Proceedings 1970: 4-5 (1970) [En]

Betaine is highly specific in its stimulation of vitamin B<sub>12</sub> biosynthesis by *Pseudomonas denitrificans* since it cannot be replaced by closely related compounds. *Ps. denitrificans* was cultivated in a synthetic medium,

incorporating <sup>14</sup>C-betaine labelled in the methyl, C-2, and COOH positions to ascertain the precursor function of this compound. The vitamin was purified by standard chromatographic, solvent extraction, and crystallographic techniques. Although betaine was rapidly degraded during the fermentation, a precursor function could not be demonstrated. Isotopic analysis of the purified vitamin, degradation products of the vitamin, and other fermentation products revealed a labelling pattern consistent with the specific radioactivity of the total C pool. Isotopic





competition expt. utilizing unlabelled methionine and  $^{14}\text{C}$ -methionine indicated that betaine was incorporated into vitamin  $\text{B}_{12}$  via the methylation reaction. The absolute requirement for betaine in  $\text{B}_{12}$  biosynthesis, therefore, is a regulatory rather than a precursor function. [See preceding abstr.] AS

## 10 B 91

## Evaluation of surfactants for use in microbiological analyses.

Dockstader, W. B.; Groomes, R. J.

Bacteriological Proceedings 1970: 6-7 (1970) [En]

[US Food and Drug Administration, Washington, DC, USA]

Products with high lipid content when subjected to microbiological analyses require the use of a dispersing agent to obtain sample homogeneity. Some of these dispersants have been shown to have occasional detrimental effects on

bacterial growth. Several nonionic surfactants were tested along with "Tergitol-7", a commonly used anionic surfactant. Lactose broth plus 1% surfactant containing 2 or less organisms/ml of 1 to 10 test cultures (4 *Salmonella*, 2 *Shigella*, 2 *Staphylococcus aureus*, *Bacillus*, and *Pseudomonas aeruginosa*) was incubated and plate counts were made during the growth cycle. In nearly all instances, the nonionic surfactants permitted greater growth response in less time than the anionic "Tergitol-7". The anionic surfactant caused a longer lag time and resulted in a 1- to 4-log population decrease in the stationary phase. "Alcolec granules" (purified soya phosphatides), and Tween-80 (polyoxyethylene sorbitan monooleate), generally had least effect on the test cultures. AS

## 10 H 1137

## A study on an acetic acid-forming bacterial isolate and factors influencing its growth and production of acetic acid or vinegar from alcoholic medium.

Maceda, L. M.; Palo, M. A.

Philippine Journal of Science 96 (2) 111-27 (1967 (published 1969)) [12 ref. En] [Nat. Inst. of Sci. and Technology, Manila, The Philippines]

115 isolates derived from rotting ripe sugary fruits, palm saps and raw vinegar which were screened for acetic acid production yielded 8 strains capable of producing >3% acetic acid from 6% ethyl alcohol in Janke's medium. On further testing in Janke's and in yeast-fermented banana media, isolate 67- $\beta$  from a rotting mabolo fruit (*Diospyros discolor* Willd.) proved the best, with acetic acid-producing efficiency of 54.34 and 55.19% in 8% ethyl alcohol obtained in Janke's and banana medium respectively. Highest acetic acid production was obtained in 10% alcohol though with slightly lower efficiency (46.11 and 46.22% for the 2 media respectively). The bacterium was identified as *Acetobacter rancens* ( Beijerinck) var. *turbidans* Frateur. Morphological and physiological characteristics are described. Optimal conditions for growth and acetic acid production are: pH 5, temp. 28-32°C, N source 0.02% available N as yeast extract, bacto-peptone or  $\text{NH}_4\text{H}_2\text{PO}_4$ . Growth was inhibited

## 10 J 1050

## The nata organism - cultural requirements, characteristics, and identity.

Lapuz, M. M.; Gallardo, E. G.; Palo, M. A. Philippine Journal of Science 96 (2) 91-109 (1967 (published 1969)) [20 ref. En] [Nat. Inst. of Sci. and Technology, Manila, Philippines]

Organisms responsible for production of nata, a popular Filipino delicacy were isolated from rotting fruits of mango, guava, pineapple, sineguelas (*Spondias purpurea* L.), chico (*Achras*

*sapota* L.) and ates (*Annona squamosa* L.) and from fermenting vinegar and compared for thickness of nata formed on a synthetic medium. The isolate producing thickest nata formation was used for systematic studies. Cultural requirements were: pH 5-5.5, temp 28-31°C, dextrose or sucrose 10%,  $\text{NH}_4\text{H}_2\text{PO}_4$  0.5% and nutrient medium (coconut water). Morphological, cultural and physiological characteristics showed the organism to be *Acetobacter xylium* (Brown) Holland, a gram-negative non-motile rod, whose distinctive character is the ability to form a cartilaginous membrane which holds the cells together and gives a positive cellulose test. RM

## 10 P 1292

## Characterization and classification of psychrotrophic bacteria in milk by means of temperature-gradient incubation.

Nakae, T.

Milchwissenschaft 25 (3) 161-67 (1970) [27 ref. En, de, fr] [Faculty of Agric., Univ., Okayama, Japan]

An extensive survey of psychrotrophic bacteria in milk and dairy products in Japan has been carried out over 4 yr, and some results have already been published [FSTA (1970) 27B50 & 7H859 & Tohoku J. agric. Res. (1967) 18 (4) 247-55]. The present paper deals with temp. relations for growth of 456 strains of psychrotrophic bacteria isolated from 138 samples of raw and market milk, butter, cheese, ice cream and fermented milk. The strains were identified as 237 *Pseudomonas*, 21 *Alcaligenes*, 126 *Achromobacter*, 10 *Flavobacterium*, 18 coli-aerogenes group, and 44 Gram-positive bacteria including streptococci, micrococci, and bacilli. Temp. gradient incubation studies showed considerable variations in max. growth temp., although this and the lethal incubation temp. increased gradually with a rise in optimum growth temp. When incubated for 24 h, min. growth temp. ranged from 8 to 18°C regardless of the variation in other cardinal temp. On the basis of optimum, max. and lethal temp., 347 strains were classified as mesotrophic psychrotrophs and 109 as psychrotrophic mesophiles, but none as true psychrotrophs. CDA

## 10 P 1329

## [Psychrotrophic micro-organisms in farm-stored milk and their proteolytic activity.]

Kiuru, K.; Eklund, E.

Karjantuntuote 53 (4) 124-26 (1970) [9 ref. Fi] [Yliopiston Maitotalouslaitos, Helsinki, Finland]

The psychrotrophic bacteria investigated belonged to the genera *Aerobacter*, *Flavobacterium* and *Pseudomonas*. They were incubated for 7-19





days at 4°C (in a few cases at 8°C). Under experimental conditions the proteolytic action on casein was rather slow (the cell concentration in substrate being  $\geq 10^8$ /ml). In the first place  $\alpha_s$ - and  $\beta$ -caseins were attacked, and some strains also produced enzymes hydrolysing  $\kappa$ -casein. NK

#### 11 C 259

**Micro-organisms from arms and hands of dairy plant workers.**

Sunga, F. C. A.; Heldman, D. R.; Hedrick, T. I. *Journal of Milk and Food Technology* 33 (5) 178-81 (1970) [15 ref. En] [Dept. of Food Sci., Univ., East Lansing, Michigan 48823, USA]

Micro-organisms shed from arms and hands of 4 dairy plant workers into a chamber containing filter-sterilized air were collected on plates of various selective media using a Casella sampler. 256 micro-organisms, representative of the types encountered, were selected for identification. 142 isolates were cocci, the predominant spp. being *Sarcina flava* (40), *Peptococcus prevotii* (28), *S. aurantiaca* (27), *S. hansenii* (16) and *Staphylococcus epidermidis* (11); 106 isolates were rods, the predominant spp. being *Alcaligenes marshallii* (29), *Alc. bookeri* (22) and *Pseudomonas synxantha* (12); and 8 isolates were yeasts, 6 being *Saccharomyces* and 2 *Candida* spp. Disinfection of the arm and hand with benzyl ammonium chloride after washing did not drastically change the spp. of micro-organisms shed, but further sampling is necessary before any significant conclusions can be drawn. CDA

#### 11 P 1466

**The effect upon bacterial survival of sanitizer residues on a soiled surface.**

Leggatt, A. G.

*Journal of Milk and Food Technology* 33 (4) 121-25 (1970) [14 ref. En] [Dept. of Food Sci., Univ., Guelph, Ontario, Canada]

5 disinfectants (iodophor, QAC, sodium and calcium hypochlorites and chlorinated trisodium phosphate) were tested for their bactericidal properties in the presence of milk film. The test method consisted of spreading a disinfectant solution on a dried sterile skim-milk film on a glass slide, allowing it to dry, then spreading a bacterial suspension over the treated film and keeping it moist for 2 min or 4 h before overlaying with nutrient agar. Colonies were counted after incubation for 3 days at the optimum temp. of the test organism, and compared with control counts from slides not treated with the disinfectant. None of the disinfectants was bactericidal at 0.01% concn. to *Pseudomonas fluorescens*, *Serratia marcescens*, *Escherichia coli*, *Sarcina lutea* or *Micrococcus freudenreichii*. The iodophor and QAC at concn. of 0.1% appeared to stop all multiplication and there was little difference between the effects on Gram-positive and -negative spp. Response to the hypochlorites was erratic, particularly with Gram-positive organisms and the chlorinated trisodium phosphate was more effective against Gram-negative than -positive spp. Differences in response between the 5 organisms were more apparent after 4 h than 2 min exposure. CDA

#### 11 R 405

**[Histidine decarboxylase in microflora of frozen sea fish.]**

Ilieva, R.

*Veterinarnomeditsinski Nauki* 7 (5) 105-08 (1970) [8 ref. Bg, ru, en] [Vet. Inst. po Zarazni i Parazitni Bolesti, Sofia, Bulgaria]

No histidine decarboxylase was detected by Scheibner's method [Z. ges. Hyg. (1968) 14 (3) 204-06] adapted for psychrophilic micro-organisms in 3 strains of *Pseudomonas*, 5 of *Achromobacter*, 2 of *Flavobacter* and 1 of *Aeromonas* isolated from frozen corb (*Umbrina cirrosa*) stored for 3 months at -18°C. SKK

#### 12 C 278

**[Comparative investigation of bactericidal power of some modern disinfectants used in the food industry.]**

Kenderesi, S.; Ilic, M.

*Hrana i Ishrana* 10 (8) 433-38 (1969) [8 ref. Sh, en]

The bactericidal action of some quaternary ammonium compounds (Omnisan, Dodigen 226, Meripol BQ) and the ampholytic surface active agent Tego 51, in 0.02 and 0.1% concn., on 6 bacterial spp. (*Escherichia coli*, *Proteus vulgaris*, *Staphylococcus aureus*, *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Bacillus subtilis*) was examined. No spores of *B. subtilis* were destroyed by the disinfectants, vegetative cells of the 6 spp. varied in their behaviour, but all were killed after exposure to the disinfectants for 5 min at 18-20°C. The presence of 10% of milk diminished the action of the disinfectants (e.g. the activity of Tego 51 was reduced 3-4×, that of quaternary ammonium compounds 20-50×). None of the disinfectants, in concn. applied in normal use, were toxic to mice and none caused corrosion of laboratory instruments. IN

#### 12 G 423

**[Method for producing a protein concentrate.]**

Verfahren zur Herstellung eines Eiweisskonzentrates.

Griehl, W.; Suter-Homuth, C. (Inventa AG)

Swiss Patent 482 832 (1970) [De]

Cyclohexane oxidation by-products are subjected to an aerobic fermentation by a pseudomonad, pref. *Pseudomonas fluorescens*, at 24-30°C and pH 6.7-9.2 in a concn. of 0.2-50% by wt. of the culture medium. Air and/or O<sub>2</sub> are supplied at a rate of 1 vol. gas/vol. reaction mixture/min, preferably at 25°C and pH 7.0-8.0. The reaction mixture is preferably stirred at 230-1200 rev/min. The max. number of cells may be reached after 50-90 h. The cell material is separated by centrifugation and dried by one of the conventional methods. The resultant high-grade protein concentrate is rich in essential amino acids. W&Co





12 P 1748

[Deterioration of cold-stored milk by *Pseudomonas fragi*.]

Savolainen, J. E. T.; Mantere-Alhonen, S.  
 Karjantuntu 52 (11) 372-74 (1969) [12 ref. Fi, de]  
 [Yliopiston Mikrobiologian Laitos, Helsinki,  
 Finland]

*Pseudomonas fragi* spoils cold-stored milk mainly through the formation of fruity aroma, which is derived from the amino acids of casein. Addition of 0.1 ml ethanol/100 ml milk increased this aroma distinctly. Alanine, glutamic acid, leucine and serine acted as precursors of the aroma substance after the addition of ethanol. Aroma was also produced from glucose and sodium lactate after adding ethanol. The aroma substance contained iso- and n-butyric acid, iso- and n-valeric acid and probably iso-caproic acid. In the case of ethanol addition the presence of acetic acid was also likely. In a synthetic alanine substrate, only acetic and n-valeric acids were formed. The amounts of acids varied between 3 and 30  $\mu$ -equiv./5 l. substrate. NK

12 P 1750

Lipolytic and psychrotrophic bacteria in cold-stored milk.

Bockelmann, I. von  
 International Dairy Congress (18th, Sydney) 1E:  
 106 (1970) [En] [Food Res. Inst., Alnarp, Sweden]

In milk cold-stored at the factory, 18% of the total count on the 1st day and 65% on the 3rd day were psychrotrophs. Of *Pseudomonas* strains which constituted ~50% of the psychrotrophic flora, 77% were lipolytic, 85% caseolytic and 60% liquified gelatin; other psychrotrophic spp. were less lipolytic and proteolytic. CDA

12 P 1751

Reduction of airborne micro-organisms in a bipolar-oriented electrical field.

Stersky, A.; Helman, D. R.; Hedrick, T. I.  
 International Dairy Congress (18th, Sydney) 1E:  
 160 (1970) [En] [Dept. of Food Sci., St. Univ.,  
 East Lansing, Michigan, USA]

Application of a bipolar-orientated electrical field at 14 000-20 000 volts caused the following mean reduction in the airborne population of various organisms, when continuously aerosolized for 5-7 h; *Serratia marcescens*, 49.1%; *Pseudomonas fragi*, 59.2%; *Bacillus subtilis*, 49.1%; *Candida lipolytica*, 47.7%; and *Penicillium roqueforti*, 31.0%. CDA

## VOLUME 3

1 H 38

[Microbiological studies on frozen foods. III.  
 Survival of bacteria on freezing in vegetable  
 juices.]

Yokoyama, M.; Shibasaki, K.  
 Journal of Food Science and Technology [Nihon  
 Shokuhin Kogyo Gakkai-shi] 16 (2) 69-73 (1969) [6

ref. Ja, en] [Dept. of Food Chem., Fac. of Agric.,  
 Tohoku Univ., Sendai, Japan]

Effects of temp. down to -40°C and rate of freezing on the survival of bacteria and *Pseudomonas*, *Achromobacter* and *Flavobacterium* spp isolated from commercial frozen foods, are described. HE

1 P 26

Current Australian research. Dairy Research Seminar, December 1969.

Loftus-Hills, G.; Silcock, K. M.  
 Australian Journal of Dairy Technology 25 (2) 95-105 (1970) [En]

At this seminar, held at Melbourne Univ. in Dec. 1969, the following current research projects were amongst those reviewed: heat treatment of milk, by J. G. Teese; production of rindless Gouda type cheese, by L. A. Hammond; the chemistry of cheesemaking, by J. Conochi; deep frozen starter concentrates, by G. T. Lloyd; rheology of processed cheese, by M. A. Thomas; chemistry of casein fractions, by R. Beeby; effect of season of milk powder recombining qualities, by G. C. Farrell; milk esterases, by B. J. Kitchen; proteolysis by *Pseudomonas*, by H. S. Juffs; a carbohydrate-free milk product, by J. Henderson; commercial utilization of the milk biscuit, by R. A. Buchanan; quality of butter at point of sale, by A. F. Hehir; economic aspects of continuous buttermaking, by S. Ip, D. Cox & T. Phillips; spreadability of butter, by B. D. Dixon and V. Maitland; fractionation of butterfat, by B. C. Baker; cheese grading, by P. M. Linklater & A. W. Randell; research and development policies, by K. T. H. Farrer; lactose intolerance in South-East Asians, by A. E. Davis & T. D. Bolin; UHT whipping cream, by G. Zadow; and manufacture and use of co-precipitates, by L. L. Muller. CDA

1 P 54

[Causes of lipolysis inhibition in enumeration of lipolytic micro-organisms.] Ursache der Hemmungerscheinungen bei der Bestimmung fettsäurebildender Mikroorganismen.

Brandl, E.  
 Österreichische Milchwirtschaft 25 (12) Wiss.  
 Beil, Nr. 5: 39-52 (1970) [32 ref. De, en] [Inst.  
 für Milchwirtschaft u. Mikrobiologie, Hochschule  
 für Bodenkultur, Vienna, Austria]

The inhibitory activity of *Bacillus subtilis* on the lipolytic activity of a *Staphylococcus* sp. (Baird-Parker group III), *Pseudomonas fluorescens* and *Serratia marcescens* was investigated using culture and cell-free extract preparations and methods as described previously [FSTA (1970) 2 10B90]. Inhibition of lipolysis was not due to a change in pH during growth on nutrient agar, but appeared to be caused by extracellular proteinases of *B. subtilis*; this inhibition of lipolysis could be demonstrated with either Victoria blue butterfat or tributyrin substrates used for detection of lipolysis. The rate of lipase inactivation increased with proteinase





concn.; optimum temp. for inhibitory activity was 37°C. Lipase activity of the *Staphylococcus* sp. was more strongly inhibited than that of the other 2 organisms. [See also XVII Int. Dairy Congr. (1966) B 467-71.] CDA

1 P 188

[Studies on psychrotrophic bacteria in cows' milk. I. Examination of psychrotrophic bacteria in raw milk.]

Nakanishi, T.; Tanabe, T.

Japanese Journal of Dairy Science [Rakuno Kagaku no Kenkyu] 19 (2) A44-A50 (1970) [5 ref. Ja, en] [Fac. of Agric., Tohoku Univ., Sendai, Japan]

Psychrotrophic bacterial counts in raw milk from 2 farms were 49 and 51/ml immediately after milking; on arrival at 2 milk plants respectively, psychrotrophic counts were 9.4 million and 3.3 million/ml immediately after sampling, and 210 million and 540/ million/ml after storage for 10 days at 5°C. The psychrotrophic flora of milk sampled at the farm contained 80-95% *Pseudomonas* spp. During transportation, for which low-temp. storage was not always employed, the higher temp. favoured growth of *Achromobacteriaceae* and *Enterobacteriaceae*; when sampled at the plant, the psychrotrophic flora contained only 30-35% *Pseudomonas* spp., but after storage for 10 days at 5°C, the proportion of *Pseudomonas* spp. had increased to 85-95%. [From En summ.] CDA

1 S 22

Gelled meat product.

Schupper, H. R., Fr. (Kelco Co.)

United States Patent 3 519 434 (1970) [En]

Homogeneous gelled meat product contains both a *Xanthomonas* hydrophilic colloid and locust bean gum in quantities sufficient to form a gel through interaction. IFT

1 S 46

Growth of psychrotolerant pseudomonads and *Achromobacter* on chicken skin.

Clark, D. S.

Poultry Science 47 (5) 1575-78 (1968) [17 ref. En] [Div. of Biol., Nat. Res. Council, Ottawa, Ontario, Canada]

Scalding of the skin affected the growth rate of both *Pseudomonas* and *Achromobacter*. The former grew best on skin scalded at 59°C, and the latter grew best on unscalded skin. The study showed that any location on the skin of the bird is suitable for sampling tests to determine the bacteriological quality of whole refrigerated poultry. Bird-to-bird variability, skin age and location, and freezing and thawing of skin samples had no significant effect on the growth rate of either type of organism. JA

1 S 95

Effect of psychrotolerant bacteria on the amino acid content of chicken skin.

Adamcic, M.; Clark, D. S.; Yaguchi, M.

Journal of Food Science 35 (3) 272-75 (1970) [22 ref. En] [Div. of Biol., Nat. Res. Council of Canada, Ottawa, Canada]

Changes induced by type-cultures of *Achromobacter*, nonpigmented *Pseudomonas*, pigmented *Pseudomonas* and a mixture of all 3 types in the amino acid content of fresh chicken skin were studied during storage at 5°C for up to 21 days. The *Achromobacter* and nonpigmented *Pseudomonas* cultures reduced the amount of all amino acids to below detectable levels during the early log phase of growth and produced no detectable change subsequently. The pigmented *Pseudomonas* caused no appreciable change initially but produced a marked increase in the amount of most amino acids during the late log phase, after off-odour had developed; an increase in free and total extractable proline and hydroxyproline indicated that collagenous proteins were attacked. The mixed inoculum gave intermediate results, producing comparatively little change in the total free amino acid content throughout the incubation period. Results indicate that the pigmented pseudomonads are the most proteolytic of the common types of psychrotolerant spoilage bacteria and that they possess collagenase. AS

1 T 63

Effect of improved air distribution and air dispersion on fermenter performance.

Enenkel, A.

Abstracts of Papers. American Chemical Society 160: MICR1 (1970) [En] [Lab. of Heinrich Frings, Jagerstrasse 9, 53 Bonn, W. Germany]

In an effort to produce vinegar by submerged fermentation a new aeration system was developed some time ago. The reason for this new system is apparent from the fact that if *Acetobacter* have their air supply cut off for only seconds, substantial numbers of them die thereby reducing the production of a typical submerged type vinegar production fermenter. The new design aeration system has been quite successful in the limited field of vinegar production. This paper gives the results that have been obtained in yeast and some other common aerobic fermentation. While the data is, at the moment, quite limited, the observed results with this improved design are quite interesting. Improved cell growth and improved product yield are the more important advantages observed although greater O<sub>2</sub> usage can also be shown. AS

2 M 239

[Studies on bacteria found on the surface of freshly harvested rice. V. Growth limits of 3 isolates.]

Matsuno, M.

Report of the Food Research Institute [Shokuryo Kenkyusho Kenkyu Hokoku] 24: 18-22 (1969) [7 ref. Ja, en] [Food Res. Inst., Ministry of Agric. and Forestry, Koto-ku, Tokyo, Japan]

The growth limits of *Erwinia herbicola*, *Pseudomonas schuelleri* and *Ps. straminea*





were studied in asparagine broths, the densities of which were controlled either with NaCl or with sucrose. Growth was better at 30°C than at 15°C. Growth limits in salt- and sucrose-controlled broths respectively were: *E. herbicola*, 1480-1600 m-osmoles and 910-940 m-osmoles; *Ps. straminea*, 543-610 m-osmoles and 568-608 m-osmoles; and *Ps. schuylkilliensis*, 1320-1410 m-osmoles and 910-940 m-osmoles. HE

## 2 P 280

### Milk gel composition.

Schuppner, H. R., Jr. (Kelco Co.)

United States Patent 3 507 664 (1970) [En]

A composition suitable for forming a milk gel composition comprises a finely divided, relatively homogeneous mixture of a tetra-alkali metal, pyrophosphate (1.5-3.5 g/pint milk), an edible calcium salt (1-5 g/pint) and a *Xanthomonas* hydrophilic colloid/locust bean gum mix (0.5-4 g/pint, 1:1 ratio). A gelled milk product is made by simply adding the above gelling composition to cold milk, agitating and refrigerating. HBr

## 2 R 57

Effect of gamma radiation on the metabolic pathways in the synthesis of trimethylamine by *Pseudomonas erythra*.

Reddy, G. V.

Dissertation Abstracts International. Section B. The Sciences and Engineering 30 (11) 5090 (1970) [En] [St. Univ., Baton Rouge, Louisiana 70803, USA]

Effects of low-dose irradiation (200 krad) of *Pseudomonas erythra* on the production of trimethylamine were examined. Compounds (amino acids, choline, ethanolamine, pyridoxine) important in trimethylamine production were quantitatively determined at 0, 5, 10, 15 and 20 days of incubation, and treatment combinations were control oysters, oysters (irradiated or not) with the organism (irradiated or not). Amino acids in oyster tissue were analysed by paper chromatography and determined by a Beckman model 120C amino acid analyser. Acids identified were: methionine, leucine, isoleucine, tyrosine, phenylalanine, glutamic acid, glycine, valine, and alanine. The irradiated and non-irradiated samples were compared; significant findings were an increase in choline and ethanolamine during incubation, reaching high concn. in inoculated samples (max. with non-irradiated organism). In all cases irradiation reduced the concn. of pyridoxine. GLS

## 2 S 140

Hydrogen sulphide production by bacteria and sulphmyoglobin formation in prepacked chilled beef.

Nicol, D. J.; Shaw, M. K.; Ledward, D. A. Applied Microbiology 19 (6) 937-39 (1970) [11 ref. En] [Meat Res. Lab., CSIRO, Div. of Food Preservation, Cannon Hill, Queensland 4170,

Australia]

A bright green exudate occasionally produced from meat stored at 1-2°C under low oxygen tension, was identified as sulphmyoglobin by spectrophotometric methods. Sulphmyoglobin was converted from myoglobin by H<sub>2</sub>S produced by bacterial attack on S-containing amino acids. The bacteria involved were tentatively identified as *Pseudomonas mephitica*. The conditions for H<sub>2</sub>S production were an oxygen tension of ~1% and a pH ≥ 6.0. AHV

## 2 S 183

### [The use of meat tenderizers.]

Seynave, R.

Recueil de Medecine Veterinaire de l'Ecole d;Alfort 146 (9) 877-95 (1970) [2 ref. Fr, en, es] [Abattoirs de la Communaute Urbaine 59-Lille, France]

Results of an investigation of meat tenderizing apparatus in the Lille district during 1969 are presented. Although 90% of the butchers surveyed used tenderizers, only 3% did so at the request and in view of the customer as is required. Microbiological investigation of 100 samples of meat residues adhering to the apparatus showed that 91 of them contained potential pathogens including salmonellae in 5, *Clostridium perfringens* in 85 and pathogenic staphylococci in 68. In cases of heavy contamination *Proteus hauseri*, *Pseudomonas* and *Citrobacter* were also found. There was no significant correlation between the amount of residue left on the apparatus and the degree or type of contamination. The incidence of contamination appears to depend on the time elapsing between washings of the apparatus. Contamination was more frequent at bulk caterers and school canteens than in butchers shops. AH

## 3 B 21

SOS/70. 3rd International Congress of Food Science and Technology, Washington, DC, Aug. 9-14, 1970. Abstracts of papers. Microbiology. [Volunteer papers]

Denton, A. E. (United States of America, Institute of Food Technologists) (Chairman) Abstracts 118, 119, 120, 121, 122, 123, 124, 125, 126, 127 & 128 (1970) [En] [Campbell Inst. for Food Res., Camden, New Jersey, USA]

Abstracts are presented of the following papers: Bacteriology of solar salt-methods for sterilization, by W. L. Brown, C. E. MacKinnon & R. F. Gomez; Antibacterial compound produced by moulds commonly used in oriental food fermentations, by H. L. Wang, J. J. Ellis & C. W. Hesseltine; Interpretation of nonexponential survivor curves of heated bacteria, by W. A. Moats, R. Dabbah & V. M. Edwards; Probability of initiating aerobic staphylococcal growth and toxigenesis in broth and foods, by C. Genigeorgis; Mechanism of meat microbial spoilage at low temperatures, by J. M. Jay & L. A. Shelef; Antagonisms of food bioprocessing micro-organisms against food-borne pathogens, by S. E. Gilliland & M. L. Speck; Injury and resuscitation of Enterobacteriaceae after sublethal treatment, by M. E. Stiles, L. A. Roth & K. Khalifa; Heat inactivation of African





swine fever virus on fresh and cured meats, by R. S. Melo, J. D. Vigario & A. M. Ribeiro; Enterotoxin A biosynthesis by *Staphylococcus aureus* A-100, by Z. Markus & G. Silverman; Protein quality of *Cellulomonas* and *Pseudomonas*, by S. P. Yang; and Microbial peptidases for the preparation of amino acid mixtures, by Y. Mäkki. JA

### 3 R 76

**Pseudomonads and achromobacters in the spoilage of irradiated haddock of different preirradiation quality.**

Laycock, R. A.; Regier, L. W.

*Applied Microbiology* 20 (3) 333-41 (1970) [26 ref. En] [Fisheries Res. Board of Canada, Halifax, Nova Scotia, Canada]

The effect of initial quality of fish on postirradiation (100 krad) changes in the bacterial flora of haddock fillets during aerobic storage at 3°C has been investigated, with emphasis on the *Pseudomonas* and *Achromobacter* groups. The quality was related to the length of

time the eviscerated fish had been stored in ice prior to filleting. Increased numbers of organisms, in particular *Ps. putrefaciens*, were found initially on fillets cut from older fish. *Pseudomonads* were reduced by 2-3 log orders by irradiation, and *achromobacters* and gram-positive isolates predominated in the immediate postirradiation flora. Little difference could be detected in either types or relative proportions of organisms occurring during storage of unirradiated fish of different quality. *Pseudomonads* outgrew *achromobacters* and dominated the spoilage flora in all cases. After spoilage, however, the growth rate of *pseudomonad* declined markedly. In irradiated fish, *achromobacters* predominated throughout storage. In fish of better initial quality, bacterial numbers were 1-2 log orders higher at spoilage than in their unirradiated counterparts and in the poorer quality irradiated samples. The increased number of organisms was accompanied by a radical change in the character of the predominant *achromobacters*. *Pseudomonads* were found to increase in numbers during storage of irradiated fish, in particular in poorer quality fish on which they were initially present in higher numbers. Detection of *pseudomonads*, even when present in high numbers, was found to be limited by the identification techniques normally used. AS

### 3 R 118

**Microbial flora of Gulf of Mexico and pond shrimp.** Vanderzant, C.; Mroz, E.; Nickelson, R. *Journal of Milk and Food Technology* 33 (8) 346-50 (1970) [10 ref. En] [Animal Sci. Dept., A&M Univ., College Station, Texas 77843, USA]

Bacterial counts of shrimp delivered by fishing vessels to processing plants varied greatly. Aerobic plate counts at 28°C ranged from 870 to 1 300 000/g. Either natural sea-water or distilled water could be used in media preparation. The

use of artificial seawater usually resulted in lower counts. The microbial flora of Gulf shrimp was dominated by coryneforms and species of *Pseudomonas*, *Moraxella*, and *Micrococcus*. Refrigerated storage usually caused an increase in *Pseudomonas* species. Bacterial counts of pond shrimp were much lower than those of Gulf shrimp. In some samples of pond shrimp *Bacillus* and *Lactobacillus* species were predominant. AS

### 3 S 208

**Effect of microbial growth upon myofibrillar proteins.**

Rampton, J. H.; Pearson, A. M.; Price, J. F.;

Hasegawa, T.; Lechowich, R. V.

*Journal of Food Science* 35 (4) 510-13 (1970) [10 ref. En] [Dept. of Food Sci., St. Univ., East Lansing, Michigan 48823, USA]

Aseptic samples from pig and rabbit muscles were inoculated with *Achromobacter liquefaciens*, *Micrococcus luteus*, *Pediococcus cerevisiae*, *Pseudomonas fluorescens*, *Streptococcus faecalis* and a mixed culture obtained from commercial hamburger. Some difficulty was encountered in getting the organisms to grow, and good growth was achieved only with *Achr. liquefaciens* and the mixed culture from commercial meat. Both inoculated and uninoculated control samples were incubated at 3 and 10°C for 0, 8 and 20 days. The salt soluble proteins were extracted with Weber-Edsall solution and subjected to sucrose density gradient centrifugation, gel filtration and disc gel electrophoresis. The microorganisms utilized in this study had no measurable effect upon the myofibrillar proteins from either pig or rabbit muscle. However, bacterial growth decreased the amount of certain non-protein UV absorbing components in the ultracentrifugal pattern of Weber-Edsall extract. These components did not appear to be of myofibrillar origin. Disc gel patterns of Weber-Edsall extracts from pig muscle produced a more intensely staining band than those from rabbit muscle at  $R_m = 0.59$ . AS

### 3 S 298

**Microflora of fresh pork sausage casings. I. Regenerated collagen casings.**

Riha, W. E., Jr.; Solberg, M.

*Journal of Food Science* 35 (4) 356-59 (1970) [23 ref. En] [Dept. of Food Sci., Rutgers Univ., The St. Univ., New Brunswick, New Jersey 08903, USA]

Regenerated collagen casings had contamination levels varying from <50 up to 32 000 microorganisms/g. Greatest recoveries of microorganisms were obtained on the less inhibitory media. Aerobic recovery on Tryptone Glucose Extract Agar was slightly higher than anaerobic recovery on Brewer's Anaerobic Agar. Anaerobic recovery on differential media was similar to aerobic recovery. 61 isolates were obtained from casings by enrichment techniques followed by streak plating. Of these isolates, 57.3% were of the genus *Bacillus*, 8.2% *Pseudomonas*, 6.6% *Clostridium*, 6.6% *Streptococcus*, 6.6% *Lactobacillus*, 3.3% *Micrococcus*, 3.3% *Corynebacterium*, 1.6% *Staphylococcus*, 1.6% *Escherichia* and 1.9% *Propionibacterium*. AS





3 S 334

Microbiological, sensory and pigment changes of aerobically and anaerobically packaged beef. Pierson, M. D.; Collins-Thompson, D. L. Ordal, Z. J.

Food Technology 24 (10) 1171-75 (1970) [21 ref. En] [Dept. of Food Sci., Univ., Urbana, Illinois 61801, US]

Fresh top round steaks were packaged in an O<sub>2</sub> permeable film (MSAD 80 cellophane) and an O<sub>2</sub> impermeable film (Capran 77K), and stored at 38°C for 15 days. The bacteriological changes occurring during storage were enumerated by the use of selective plating media. Colour, odour and flavour changes were evaluated. Both the initial and extended storage changes of the meat pigments were determined by reflectance spectrophotometry. The total bacterial count increased much more rapidly and was always higher with aerobic packaging. ~90-95% of the total count in anaerobic packaging were lactobacilli. Fluorescent pseudomonads rapidly increased in number under aerobic conditions while there was no change in numbers under anaerobic conditions. Microbacterium thermosphactum as well as gram negative (oxidase negative) bacteria decreased in number in the anaerobically packaged samples. An initial formation of metmyoglobin with a subsequent reduction to myoglobin was demonstrated in the anaerobically packaged beef. The rate at which the pigments reverted to the myoglobin state, in anaerobic packaging, was decreased as the time between slicing and packaging was increased. The oxymyoglobin of aerobically packaged beef was completely oxidized to metmyoglobin in <5 days of storage. Under anaerobic conditions, myoglobin formed at the surface of the meat within a few hours after packaging and persisted throughout the entire storage period. The sensory evaluation indicated that there was little difference between fresh beef and anaerobically packaged beef for a period of at least 10 days. Aerobically packaged beef was unacceptable after 4 days of storage. AS

4 C 63

[A study on so-called non-specific food poisoning outbreaks in Hungary.] Über sogenannte unspezifische Lebensmittelvergiftungen in Ungarn. Ormay, L.; Novotny, T.

Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, I. Originale 215 (1) 84-89 (1970) [3 ref. De, en] [Inst. für Ernährungswissenschaft, Budapest IX, Hungary]

Between 1960 and 1968, 20% of the food poisoning outbreaks in Hungary were caused by facultative pathogenic bacteria. These outbreaks were generally large and in some cases involved several hundred people. The facultative pathogens causing most non-specific outbreaks in this period were *Bacillus cereus* (46.2% of outbreaks), *Pseudomonas aeruginosa* (15.2) and *Proteus* spp. (13.9). Meat dishes played a significant role as the vehicle of infection. Most outbreaks occurred as a result of poor hygiene and malpractices in mass catering establishments. MJS

4 H 522

[Yeast flora of soft drinks.] Zur Hefe-Flora von Erfrischungsgetränken.

Sand, F. E. M. J.

Brauwelt 110 (15) 225-36 (1970) [100 ref. De, en, fr] [Mikrobiol. Abt. Naarden, Naarden-Bussum, The Netherlands]

After reviewing the rate of contamination and the groups of microorganisms responsible for spoilage of soft drinks in 11 European countries, the author describes the different "soft drink illnesses" and their causes. Spoilage is commonly caused by yeasts of the genera *Saccharomyces*, *Candida*, *Hansenula*, *Pichia* and *Torulopsis*, and by pectinolytic organisms or Gram-negative bacteria of the genera *Acetomonas*. Their toxicity depends on the dynamics of yeast growth, initial number of organisms and physical-chemical properties of substrate and quantity of antimicrobial components. Simple methods for epidemiological and ecological examination for oranges and for isolation and determination of punicious organisms are outlined. The results of own investigations are discussed or given in tabular form. TUB-IGB

4 H 595

[Method and device for clarifying a fermentation liquid obtained by bottom-fermentation.] Verfahren und Vorrichtung zum Klären einer vermittels Untergärung erhaltenen Gärflüssigkeit.

Tantawi, M. H. A.; Maseeh, W. R. A.; Madi, A. M. (Societe des Sucreries et de Distillerie d'Egypte) West German Patent Application 1 804 209 (1970) [De]

Microorganisms contained in a fermentation liquid, e.g. *Acetobacter* contained in vinegar, are removed by passing compressed air upwards through the liquid. Air bubbles of a pre-determined size entrain them and they collect in a layer of foam on the surface. The clarified liquid is extracted through a bottom aperture. The bacteria, etc. may be re-cycled. W&Co

4 J 412

Almond harvesting, processing, and microbial flora.

King, A. D. Jr.; Miller, M. J.; Eldridge, L. C. Applied Microbiology 20 (2) 208-14 (1970) [13 ref. En] [W. Regional Res. Lab., Agric. Res. Service, Albany, California 94710, USA]

Using a statistical sampling plan the microbial quality of almonds received at the processing plant was determined by standard plating techniques. Total aerobic bacterial count and yeast and mould counts were low compared with other foods that are not dry processed. Hard shelled varieties of almonds had lower counts than soft shelled varieties. Contamination was greater in nuts with damaged shells. Bacterial counts were found to be related to the amount of soil mixed with the sample. During storage of almonds the total plate count, *Streptococcus* and *Escherichia coli* counts after an initial drop remained nearly constant for more than 3 months. A rapid drop in microbial counts occurred during



processing of the nuts. Species of bacteria isolated included *Streptococcus*, *E. coli*, *Bacillus* sp., *Xanthomonas*, *Achromobacter*, *Pseudomonas*, *Micrococcus* or *Staphylococcus* and *Brevibacterium*. AH

#### 4 L 315

[Fermentation-produced sugars.]

Kyowa Hakko Kogyo Co. Ltd.

Japanese Patent 24 833/70 (1970) [Ja]

Micro-organisms belonging to the *Arthrobacter*, *Brevibacterium*, *Micrococcus*, *Corynebacterium*, *Pseudomonas* or *Candida* groups are cultured in hydrocarbon media to produce sugars. IFT

#### 4 Q 80

The effect of egg shell quality on penetration by *Pseudomonas fluorescens*.

Sauter, E. A.; Petersen, C. F.

Poultry Science 48 (5) 1525-28 (1969) [9 ref. En]

[Poultry Sci. Dept., Univ., Moscow, Idaho 83843, USA]

Eggs of 3 levels of shell quality as measured by sp. gr. (1.070, 1.077, 1.085) were dipped in suspensions of *Pseudomonas fluorescens* ( $1.1 \times 10^6$  organisms/ml on average) for periods of 1, 3 or 5 min. Eggs of low sp. gr. had more fluorescent spoilage during 8 wk of storage. A higher % of the non-fluorescent eggs in this group contained viable bacteria than in those groups of better shell quality eggs. The addition of metal salts to the test-suspension also increased both fluorescent spoilage and the numbers of eggs containing viable microorganisms. AS

#### 4 Q 87

Microbial flora of commercially pasteurized egg products.

Shafi, R.; Cotterill, O. J.; Nichols, M. L.

Poultry Science 49 (2) 578-85 (1970) [16 ref. En]

[Dept. of Food Sci. and Nutr., Univ., Columbia, Missouri 65201, USA]

44 samples of commercially pasteurized egg products from 6 plants were examined microbiologically. Total plate counts (TPC), psychrophilic counts, thermophilic counts and anaerobic counts were obtained. Micrococci, staphylococci and *Bacillus* were the predominant flora in frozen and dried egg products. However, gram-negative rods and yeasts were also common. The average TPC for all frozen products was 410 and for dried products 6900 microorganisms/g. Microbial flora surviving pasteurization appeared independent of the type of product examined and pasteurization processes employed. Highest TPC counts were found in whole egg (WE) and egg yolk (EY). Blends of egg products containing salt and sugar had lowest TPC when incubated at 35°C. In the dried state, the microbial count of blends paralleled that of WE. Psychrophiles, isolated at incubation temp. of 4, 7 and 13°C from frozen products, were mainly *Pseudomonas*, *Alcaligenes* and micrococci. In dried products, few psychrophilic counts were obtained below 13°C, and *Pseudomonas* of fluorescent type were absent. Coagulase-positive staphylococci were not found. The average TPC of gram-positive cocci on

tellurite polymyxin egg-yolk medium closely paralleled that of thermophilic count in WE and EY of frozen egg products. The anaerobic counts were fairly uniform in dried egg products. AS

#### 4 S 414

Gelled meat product.

Schuppner, H. R., Jr. (Kelco Co.)

Canadian Patent 855 650 (1970) [En]

A substantially homogeneous gelled meat-containing product comprises meat, water and a sufficient quantity of a *Xanthomonas* hydrophylic colloid and locust bean gum to form a firm, cohesive aqueous gel. IFT

#### 4 T 193

[Process and device for producing vinegar by submerged fermentation of alcoholic mash.]

Verfahren und Vorrichtung zur Gewinnung von essig durch submerse Vergärung von alkoholhaltigen Maischen.

Ebner, H. (Firma Heinrich Frings)

West German Patent Application 1 517 879 (1970)

[De]

Untreated vinegar, or sterile vinegar which is inoculated with a substrate containing *Acetobacter*, containing 10-13 g/100 ml acetic acid and 0.5-1.5 vol. % alcohol, is mixed with an alcoholic mash containing 0-2 g/100 ml acetic acid and ~10-14 vol. % alcohol, until a starter mash containing 6-9 g/100 ml acetic acid and 4-7 vol. % alcohol is obtained. This is uniformly ventilated at a constant temp of ~30°C. When the alcohol content equals ~0, part of the produced vinegar is extracted and fresh alcoholic mash is admixed, until the concn. of the starter mash is once more obtained for repetition of the process. Acetic acid content of the product is >12%. W&Co

#### 5 B 40

Oxidation-reduction potential and growth of *Clostridium perfringens* and *Pseudomonas fluorescens*.

Tabatabai, L. B.; Walker, H. W.

Applied Microbiology 20 (3) 441-46 (1970) [26 ref. En]

[Dept. of Food Tech., St. Univ., Ames, Iowa 50010, USA]

A new apparatus, described in detail, was developed for measuring changes in oxidation-reduction potential ( $E_h$ ), pH, and cell numbers in pure or mixed bacterial cultures.  $E_h$  has acquired increased significance with the advent of oxygen-impermeable films for vacuum-packaging meat products. Details are given for standardization of pH and  $E_h$  electrodes, sterilization of apparatus, equilibration of the cystine broth which was inoculated with food samples (e.g. gelatin desserts, beverage mixes, snacks, skim-milk powder) pre-enriched for 24 h. The tubes of differential media were observed for changes after 24 h of incubation at 35°C and on the basis of reactions noted, the samples were considered either negative or presumptive-positive. When mannitol purple and SIM media were used as the differential media to test 472 food samples for the presence of *Salmonella*, 65% of





these samples appeared negative after a 24 h enrichment period (total testing time 48 h). Presumptive-positive samples were later found to be *Salmonella*-negative using conventional cultural techniques. % of false-positives was reduced when dulcitol purple agar was used in place of mannitol purple agar. Of 671 food samples tested using dulcitol purple and SIM media, 83% were found to be negative after 48 h testing. The procedure using dulcitol purple and SIM agar as differential media appeared satisfactory for routine use in detecting *Salmonella*-negative food samples. AS

#### 5 G 184

##### Protein synthesis.

Chinese Petroleum Corp.

British Patent 1 201 638 (1970) [En]

Process is described for the biosynthesis of high protein compositions by submerged culture of *Pseudomonas* 5742 in an aqueous medium. IFT

#### 5 P 685

##### Contamination of infant feeds in a Milton milk kitchen.

Ayliffe, G. A. J.; Collins, B. J.; Pettit, F. *Lancet* 1970-I (7646) 559-60 (1970) [12 ref. En] [Hospital Infection Res. Lab., Summerfield Hospital, Birmingham 18, UK]

Infant feeds prepared in a milk kitchen of a large maternity hospital were found to be contaminated with *Klebsiella aerogenes* and, to a lesser extent, with *Escherichia coli*, *Pseudomonas aeruginosa* and other organisms. Strains of *K. aerogenes* and *Ps. aeruginosa* were typed, the former by bacteriocine and the latter by phage and serological methods. The same types of *K. aerogenes* and *Ps. aeruginosa* were found in the milk feeds as in the faeces of babies who had received the milk; they were also found in the tap of the mixing container, which was considered to be the major source of contamination of the feeds. Mixing containers, dispensers, bottles, and taps were thoroughly cleaned and then disinfected in a solution of hypochlorite; the taps could not be effectively cleaned before disinfection. A safer process of disinfection or terminal sterilization is recommended. AS

#### 5 P 719

##### Methylene blue keeping quality test and flora of market cream.

Cox, W. A.

*Journal of the Society of Dairy Technology* 23 (4) 195-202 (1970) [14 ref. En] [Unigate Central Lab., London, UK]

With the methylene blue keeping quality (MBKQ) test applied to cream, anomalous results were sometimes obtained with samples of freshly processed cream of low plate count, and from which coliforms were absent; these results were shown to be due, in some instances, to the types of bacteria present. Of 85 market cream samples, the number in which the following

incubation (17 h at 20°C) and the average MBKQ (h) on receipt and after incubation respectively were as follows: *Corynebacterium* spp., 43 and 8, 4 and 6½; *Micrococcus* spp., 7 and 2, 5½ and ; coagulase-negative staphylococci, 3 and 3, 0 and 0; *Streptococcus* spp., 6 and 10, 0 and 1; *Bacillus cereus*, 0 and 30, not tested and 3½; other *Bacillus* spp., 0 and 1, not tested and ½; oxidase-negative, Gram-negative bacteria (mainly *Acinetobacter* spp.), 12 and 12, 0-1½ and 0-1½; oxidase-positive, Gram-negative bacteria (*Pseudomonas*, *Aeromonas*, *Flavobacterium*, *Alcaligenes*), 13 and 19, 0-3 and ¼-3½. CDA

#### 5 Q 119

##### Effect of intramuscular injection of penicillin on bacterial spoilage.

Vadehra, D. V.; Baker, R. C.; Naylor, H. B.

*Poultry Science* 48 (3) 1120-21 (1969) [3 ref. En]

[Dept. of Poultry Sci., Cornell Univ., Ithaca, New York 14850, USA]

22-wk-old White Leghorn pullets were injected with 6000 IU of procaine penicillin every 24 h for 15 days. The eggs, collected 2 days after the first injection and 2 days after the last, were washed and rinsed and then dipped for 5 min into water (15°C) inoculated with *Pseudomonas aeruginosa*. Eggs from untreated control hens were treated similarly. Spoilage was greater (69.6-77.2%) in the eggs collected from hens given penicillin than in the controls (49.6-54.0%). It is suggested that the penicillin may have inhibited the synthesis of the eggshell membrane, thus making it more susceptible to bacterial attack. MEG

#### 5 R 185

##### Qualitative and quantitative changes in aerobic microflora from intestinal contents of South-Baltic cod during storage at 1-2°C.

Garcia-Tello, P.; Zaleski, S.

*Journal of Food Science* 35 (4) 482-85 (1970) [18

ref. En] [Dept. of Microbiol., Coll. of Agric., Katedra Mikrobiologii Rybactwa, Szczecin, Poland]

The bacterial flora of the intestinal content of cod (*Gadus morrhua* L.) was investigated during a period of 1 yr. The number of bacteria in recently caught fish was studied during the full period, the quality only during 6 months. 3 groups of fish from the same capture and fishing grounds were analysed: fresh, and stored at 1-2°C for 5 and 10 days. In general a Gram-positive bacterial flora dominated in recently caught fish, while after 5 and 10 days of storage Gram-negative flora outnumbered the former. In the intestinal contents of fresh fish *Vibrio* spp. dominated, whereas after storage *Pseudomonas* spp. became dominant. The bacterial flora of fresh fish was reduced during storage to 3.10% of the total initial numbers after 5 days of storage and 1.5% after 10 days. Also, the Gram-positive flora decreased comparatively more rapidly than the Gram-negative flora. It is believed that the temp. of 1-2°C may play a part in reducing the flora, together with other factors not investigated. AS





5 R 217

[Studies on the multiplication of *Aeromonas* spp. in dead fish.] Untersuchungen über die Vermehrung der Aeromonaden im toten Fischkörper. Heuschmann-Brunner, G. Berliner und Münchener Tierärztliche Wochenschrift 83 (19) 381-84 (1970) [14 ref. De, en] [Bayerische Biol. Versuchsanstalt, Munich, W. Germany.]

*Aeromonas* spp. found on the skin, gills and in the intestines of living carp, continued to develop and multiply at a considerable rate in the body of the fish after death, even penetrating the musculature. In fish kept at 10-12°C, the number of aeromonads can rise to several million/g within several days. EJM

6 B 48

Comparative study of higher alcohol production by fermenting microorganisms used in food technology. Verachtert, H.

Lebensmittel-Wissenschaft und Technologie 3 (5) 87-93 (1970) [27 ref. En, de, fr] [Lab. of Ind. Microbiol. and Biochem., Univ. of Louvain, Heverlee, Belgium]

In this extensive study of higher alcohol production by microorganisms, *Saccharomyces cerevisiae*, *Zymomonas mobilis*, *Z. anaerobia* and *Rhizopus oryzae* were grown on various media. Higher alcohols recovered from the media were estimated by colorimetry and/or gas chromatography. The following factors affecting higher alcohol production by *Sacch. cerevisiae* were studied: N-free and N-containing media, amount of inoculum, cell age, aeration, and constituents of media. All the organisms studied produced higher alcohols. *Sacch. cerevisiae* produced mainly iso-amyl alcohol and iso-butanol with smaller amounts of n-amyl alcohol and n-propanol. *R. oryzae* produced a mixture of higher alcohols with none predominating. *Zymomonas* spp. produced mainly n-propanol and iso-amyl alcohol. *Sacch. cerevisiae* produced much larger amounts of higher alcohols than the other organisms. Pre-grown cells of *Sacch. cerevisiae* and *R. oryzae* were capable of producing alcohols in pure glucose or sucrose solutions, but some strains of *Zymomonas* spp. were not. Results are tabulated and discussed in detail. MJB

6 H 875

[Action of gamma rays on the microbial flora of wines and their characteristics after ageing.] [A lecture]

Feduchy Marino, E.; Sandoval, M. Bulletin de l'Office International du Vin 43 471 523-37 (1970) [6 ref. Fr]

Sample tubes containing  $10^4$ ,  $10^5$  or  $10^6$  yeast cells/ml wine of *Saccharomyces cerevisiae*, *Sacch. oviformis*, *Sacch. beticus* (Marcilla) or *Pichia fermentans* were irradiated with 0, 100, 200, 300 or 400 krad; after 72 h growth was measured. *Sacch. cerevisiae* showed no regular sensitivity to different doses of irradiation; no growth was observed in combinations to  $10^4$  or  $10^5/300$  or 400 krad, but heavy growth in  $10^6/300$  or 400 krad. *Sacch. beticus* was not completely eliminated by doses of 400 krad; *Sacch. oviformis* was more sensitive to irradiation but was not completely eliminated by 400 krad. *Pichia fermentans* was

sensitive to 100 krad and was completely eliminated by 300 and 400 krad. Tabulated data abstracted from a lecture [A. Fernandez, Int. Yeast Congr. Delft (1969)] are given for 776 strains isolated from 182 samples of grape or apple musts in 23 countries. Using 0.5 and 1.0 Mrad in sterile filtered juice, 71% survived 0.5 Mrad and 30% 1.0 Mrad. Graphs are given of survival of  $10^1$ - $10^6$  cells of some strains after doses of 1-1000 Mrad. Malolactic bacteria showed no growth of  $4 \times 10^6$  cells/ml in 12 days after 700 krad;  $3 \times 10^6$  *Acetobacter*/ml gave no growth in 12 days after 700 krad or in 5 days after 200 krad, and only slight growth after 8 days. Wines irradiated with 300 krad had slightly higher aldehyde and ester contents than controls. JMS

6 L 468

[Process for producing pure, crystalline maltose powder.] Verfahren zur Herstellung von hochreinem kristallinen Maltosepulver. Kurimoto, M.; Sugimoto, K.; Hirao, M. (Hayashibara Co.)

West German Patent Application 1 958 014 (1970) [De]

A 10-40% starch slurry (e.g. potato, cereal, tapioca starch, etc.) is converted at 160°C to a dextrose equivalent of 1-5, in the presence of an enzyme or an acid. The slurry is saccharified with  $\beta$ -amylase and  $\alpha$ -1,6-glucosidase. Cooling is rapid to the required value for each step. Suitable  $\alpha$ -1,6-glucosidase are enzyme strains prepared from *Escherichia*, *Pseudomonas*, *Lactovaccillus*, *Micrococcus*, *Nocardia* and *Aerobacter*. The obtained sugar solution is purified, condensed by vaporization, and spray-dried to 70-80% concn. The product is for fermentation processes, food production, etc. W&Co

6 P 832

[Meeting of the German Society for Dairy Science in Giessen.] Die Deutsche Gesellschaft für Milchwissenschaft tagte in Giessen. Germany, W., Deutsche Gesellschaft für Milchwissenschaft Deutsche Molkerei-Zeitung 91 (19) 771-72; (25) 1147-49 (1970) [De]

Valid and desirable standards for microbiological evaluation of pasteurized milk, by G. Terplan (p. 771); Relationships between the required and determined quality of HTST-pasteurized milk, by H. H. Wiesner (p. 771); Bacteriological and biochemical quality of market milk from 14 supply regions of W. Germany, by A. Tolle (p. 771); *Pseudomonads* in market milk and their detection and differentiation, by G. Kielwein (p. 772); Epidemiology of  $\beta$ -streptococci in man and cattle, by G. Hahn (p. 772); Incidence of mycobacteria in milk, by W. Beerwerth (p. 772); Self-desludging separators in the dairy industry, by - Brünning (p. 1147); Bactofuge and its use in the dairy industry, by G. Damerow (p. 1147); New results obtained in the concentration of milk and whey, by J. Wiegand (p. 1147); Milk drying in the light of modern





concentrates, by - Galsmar (p. 1148); Aseptic canning, by H. Vilstrup (p. 1148); Selfpack aseptic, by W. Peschek (p. 1148); Whey protein index and rennetability as an aid in the evaluation of dried milks, by E. Voss (p. 1148). FL

#### 6 P 847

[Studies on psychrotrophic bacteria in cows' milk. II. Changes of protein in cows' milk by psychrotrophic bacteria during low temperature storage.]

Nakanishi, T.; Tanabe, T.

Japanese Journal of Dairy Science [Rakuno Kagaku no Kenkyu] 19 (3) A75-A87 (1970) [14 ref. Ja, en] [Lab. of Chem. and Tech. of Animal Products, Fac. of Agric., Tohoku Univ., Sendai, Japan]

In skim-milk inoculated with *Pseudomonas fluorescens*, the count of this organism increased >100-fold during storage for 42 days at 0.5°C, but increased only slightly at -5°C and negligibly at -15°C. Casein N in the skim-milk decreased while non-protein N increased during storage, the change being very slow at -15°C; a change in the electrophoretic pattern of casein in the skim-milk was observed during storage for 28 days at 0.5°C, but little change occurred at -5 or -15°C. Changes in the electrophoretic pattern of casein in skim-milk inoculated with *Ps. fluorescens*, *Ps. fragi*, *Flavobacterium* sp. and *Achromobacter* sp. were observed at 0 and 5°C, the changes being most marked in that inoculated with *Ps. fragi*. Skim-milk inoculated with *Ps. fragi* was peptonized after 2-4 days at 10-25°C, but not after 10 days at 0-5°C. Proteolytic activity of *Ps. nigrificans* and *Ps. putrefaciens* was stronger than that of *Ps. cohaerens* and *Acetobacter oxydans*, peptonization times being 3, 3, 7 and 7 days respectively at 10°C and 1, 1, 4 and 2 days at 25°C. At the time of peptonization, the change in electrophoretic pattern was most marked in skim-milk inoculated with *Ps. cohaerens* or *A. oxydans*, but after 7 days at 10°C the degradation of casein by all 3 of the *Pseudomonas* spp. was similar. [From En summ.] [See FSTA (1971) 3 1P188 for part I.] CDA

#### 6 S 646

Growth of psychrotolerant pseudomonads and achromobacteria on various chicken tissues.

Clark, D. S.

Poultry Science 49 (5) 1315-18 (1970) [8 ref. En] [Div. of Biol., Nat. Res. Council, Ottawa, Ontario, Canada]

Psychrotolerant pseudomonads and achromobacteria grew faster on skin than on other tissues (gut cavity lining, leg muscle, breast muscle, breast muscle lining) taken from chicken carcasses. Observations were made on rates of population growth and detectable off-odour. Differences in overall growth rates on the various tissues were attributed to differences in the duration of the lag period; cell generation times during the lag phase were nearly the same on all tissues. Differences in the lag period were not related to pH differences among the tissues. [See also FSTA (1971) 3 1S47.] AS

#### 6 S 647

Growth patterns of selected psychrophilic microorganisms in cooked and uncooked aseptically procured turkey meat.

Mast, M. G.; Mountney, G. J.

Journal of Food Science 35 (5) 618-20 (1970) [21 ref. En] [Agric. Res. and Development Center, Columbus, Ohio 43210, USA]

Sterile muscle tissue, removed aseptically from the breast of a turkey reared under commercial conditions, was inoculated with psychrophilic microorganisms capable of causing spoilage. The growth patterns of these microorganisms were compared in the cooked and uncooked samples of this sterile meat when stored at 5 and 20°C. Similar growth patterns were exhibited in both types of meat. At points on the growth curves where significant differences did occur between the 2 types of meat, levels of growth in the cooked meat were higher. The growth pattern of a mixed culture comprised of an *Alcaligenes* species and a *Flavobacterium* species was compared to that of *Pseudomonas fluorescens* in both types of meat stored at both temp. Muscle tissue inoculated with the mixed culture consistently contained greater numbers of bacteria than meat inoculated with the pure culture. Uncooked sterile turkey meat remained in good condition, both in appearance and bacteriologically, for at least 1 yr when stored at above freezing temp. AS

#### 6 T 295

[Studies on shoyu flavour by gas chromatography. II. Flavour components produced by shoyu koji microflora.]

Yamada, K.; Ino, M.

Seasoning Science

16 (5) 15-20 (1969) [14 ref. Ja]

Undesirable flavour components may be formed by the shoyu koji microflora. The following were detected by GLC ethyl alcohol, diacetyl, amyl alcohol, acetoin, acetic acid, propionic acid, isobutyric acid, n-butyric acid, and isovaleric acid as metabolites of glucose by *Bacillus subtilis*, *B. pumilus*, *Micrococcus conglomeratus*, *M. rubens*, and *M. candidus*. The metabolites also included NH<sub>3</sub> and ethyl alcohol. Their amounts varied according to the microorganism. SKa

#### 6 T 304

Presence of antioxidant materials in bacteria.

Smith, J. L.; Alford, J. A.

Lipids 5 (10) 795-99 (1970) [16 ref. En] [E. Util. Res. and Development Div., Agric. Res. Service, USDA, Beltsville, Maryland 20705, USA]

Non-enzymic antioxidant materials were obtained from washed cells of 14 species of bacteria by extraction with methanol for 24 h, evaporation to dryness, extraction with benzene. Antioxidant activity was recorded as a prolongation of the period required for the initiation of rancidity as measured by changes in the peroxide value of lard used in the test systems. The methanol soluble-benzene soluble fractions of *Bacillus cereus*, *Lactobacillus dextranum*, *Micrococcus freudenreichii* and *Sarcina lutea* and the methanol





soluble-benzene insoluble fractions of 3 *Pseudomonas* spp. showed considerable activity. In all cases the primary effect was typical of known antioxidants and extended the 'induction period' rather than decreasing the rate of oxidation. Extracts from *Pseudomonas ovalis* were the most active, 25 mg/15 g lard extended the shelf life beyond 20 days. On a wt. basis, the bacterial fractions were not as active as butylated hydroxyanisole, butylated hydroxytoluene or tocopherol. However, a true comparison cannot be made until the bacterial extracts have been further purified. LTH

#### 7 H 932

[Modern disinfection in breweries.] Moderne Desinfektion in Brauereien.

Mrozek, H.

Mitteilungen der Versuchsstation für das Gärungsgewerbe in Wien 23 (5/6) 81-86 (1969) [15 ref. De] [Mikrobiologische Lab., Henkel & Cie. GmbH, Düsseldorf, W. Germany]

Surface active disinfectants (ampholytic soaps and quaternary ammonium compounds) were tested at concn. of 1, 10, 100, 1000 and 10 000 ppm against *Staphylococcus aureus*, *Streptococcus faecalis*, *Escherichia coli*, *Aerobacter aerogenes*, *Pseudomonas aeruginosa*, *Ps. fluorescens*, *Proteus vulgaris*, *Saccharomyces cerevisiae*, *Aspergillus niger*, *Endomyces lactis*, and *Penicillium* sp. Exposure was generally at 20°C and 40°C for 1, 2.5, 5, 10, 20 and 40 min. Iodophors and hypochlorides were also tested against *Str. lactis* at pH 4.8-7.1 and 5.0-8.4 respectively; exposure was for 15, 30, 60, 120 and 300 sec. Survival rates of Gram-positive and Gram-negative bacteria and yeasts in contact with compounds containing 0.5% and 1% active chlorine at 5°C, 10°C and 20°C were determined. Quaternary ammonium compounds were found the most effective for brewery use. Active chlorine compounds were also efficient disinfectants as well as powerful cleaning and bleaching agents. Formalin had good anti-bacterial activity, but its action was slow in comparison with active chlorine compounds. Phenolic compounds are not recommended because of the dangers of flavour contamination of the product. Physical means of disinfection (UV light, heat or steam sterilization) were found impractical for breweries. OA

#### 7 Q 172

[Optical-electronic determination of eggs infected with "green rot".]

Tsarikov, N.; Chernova, G.; Pertova, T. *Myasnaya Industriya SSSR* 41 (9) 16-18 (1970) [2 ref. Ru] [Vses. Nauchno-issled. Inst. Ptitsepererabatyvayushchei Promyshlennosti. USSR]

An optical-electronic method of detecting eggs attacked by "green rot" makes possible automation of egg classification without damaging the eggs. The recommended equipment consists of a monochromator, photomultiplier, a high voltage regulated rectifier, a synchronous electric drive, recording instrument and a Hg Si lamp. It graphically records the luminiscent spectra of whole eggs, shells, yolks, whites and the membrane beneath the shell. Luminiscent spectra of eggs

attacked by "green rot" (*Pseudomonas fluorescens*) which are quite inconspicuous on an ovoscope, have a clear max. at 548-549 nm. Luminiscent spectra of individual egg components are also described. STI

#### 7 Q 179

[Eggs and egg products. VI. Insepection of egg products.]

Thieulin, G.; Basille, D.; Hautefort, M.; Gandon, Y.; Petit, A.

*Alimentaria* 7 (32) 50-56 (1970) [Es]

This review covers: legal aspects, sampling and organoleptic examination, bacteriological examination (preparation of sample, plate count, culture tube count of indole-producing and H<sub>2</sub>S-producing organisms, *Pseudomonas* count, detection of salmonellae, *Staphylococcus* count), amylase test, and chemical analysis (DM, fat). ECA

#### 7 S 813

Microflora of fresh pork sausage casings. II. Natural casings.

Riha, W. E.; Solberg, M.

*Journal of Food Science* 35 (6) 860-63 (1970) [11 ref. En] [Dept. of Food Sci., Rutgers - St. Univ., New Brunswick, New Jersey 08903, USA]

Aerobic total plate counts on tryptone glucose extract agar at 28°C varied from a level >30 000 to 59 000 000 microorganisms/g in salt-packed natural casings and from 180 000 to 23 000 000 organisms/g in wet-packed natural casings. Both salt-packed and wet-packed casings supported similar growth patterns in selective media. 38 isolates were identified from the salt-packed casings and 53 from the wet-packed. Of the salt-packed isolates, 60.5% were of the genus *Bacillus*, 7.9% *Pseudomonas*, 15.8% *Clostridium*, 1.6% *Micrococcus* and 5.3% *Gaffyka*. Those isolates obtained from the wet-packed casings included 62.3% *Bacillus*, 7.5% *Pseudomonas*, 7.5% *Clostridium*, 7.5% *Micrococcus*, 5.6% *Proteus*, 1.9% *Lactobacillus* and 5.7% unidentified. [See FSTA (1971) 3 3S298 for part I.] AS

#### 8 H 1098

Spoilage organisms in breweries.

Rainbow, C.

*Process Biochemistry* 6 (4) 15-17 & 31 (1971) [23 ref. En]

The main spoilage organisms in beer, which is a poor medium for microbial growth, are lactobacilli, including *L. pastorianus*, *L. brevis* and *Pediococcus cerevisiae*, *Acetobacter* spp., *Acetomonas* spp., *Zymomonas anaerobia* and yeasts. The metabolism of all these organisms in beer is discussed, together with possible methods for their control. It is concluded that while it may be possible to reduce spoilage by a reduction in residual nutrients in beer, this will

never take the place of strict hygienic control. WHCA





8 J 1050

[Effect of ionizing radiation on the microflora and storage life of fresh mushrooms (*Psalliota campestris*).]

Wozna, J.

Roczniki Technologii i Chemii Zywnosci 19: 89-101 (1970) [32 ref. Pl, en] [Katedra Tech. Rolnej, WSR, Poznan, Poland]

Mushrooms were packaged in polyethylene bags, and exposed to 0.05-0.5 Mrad  $\gamma$ -irradiation, and stored at room temp. or at 4°C. Irradiation caused no damage to organoleptic properties of the mushrooms. Best results were obtained with 0.5 Mrad, which destroyed >99.9% of the total microflora (which consisted of 60% *Achromobacter* spp., 29% *Pseudomonas* spp. and 0.2-5% *Flavobacterium*, *Aerobacter*, *Bacillus*, *Staphylococcus*, *Sarcina* and *Micrococcus* spp.). Storage life was extended by 2.5-3 days at room temp. and by 8.5-9 days under refrigeration. HBr

8 P 1344

[The proteolytic activity of psychrotrophic microorganisms in farm tank milk.] Die proteolytische Aktivität der psychrotrophen Mikroorganismen in der Hofbehältermilch. Kiuru, K.; Eklund, E.; Gyllenberg, H.; Antila, M. *Milchwissenschaft* 26 (3) 138-41 (1971) [6 ref. De, en] [Inst. für Milchwirtschaft, Univ., Helsinki, Finland]

53% of 300 strains of psychrotrophic microorganisms isolated from samples of farm tank milk were proteolytic and were composed of 84% *Pseudomonas*, 5% *Enterobacter*, 5% *Flavobacterium* spp. and 6% other strains. 3 strains of *Pseudomonas* and 1 each of *Aerobacter* and *Flavobacterium* were grown in sterile skim-milk and extent of hydrolysis of the milk casein was measured by fractionation of the casein on DEAE cellulose. Proteolytic changes were observed at concn. of  $\geq 6 \times 10^7$  micro-organisms/ml;  $\alpha_s$ - and  $\beta$ -casein were preferentially attacked. The *Aerobacter* strain produced a rennet-type enzyme which hydrolysed  $\alpha$ -casein. [See FSTA (1970) 2 12P1746.] SKK

8 R 337

Radiation sensitivity and biochemical characteristics of microflora of Bombay duck (*Harpodon nehereus*).

Kumta, U. S.; Mavinkurve, S. S.

*Journal of Food Science* 36 (1) 63-66 (1971) [19 ref. En] [Bhabha Atomic Res. Centre, Biochem. & Food Tech. Div., Trombay, Bombay-85, India]

The microbial flora of unirradiated and

irradiated (0.5 Mrad) Bombay duck (*Harpodon nehereus*) was differentiated into organisms as spoilers and non-spoilers based on ability to liquefy gelatin; ferment glucose; and produce indole,  $H_2S$  and urease. In spoiling unirradiated fish, there was a predominance of *Vibrio*, *Aeromonas* and *Proteus* spp. while *Micrococcus* and *Achromobacter* spp. were the major surviving groups in irradiated Bombay duck stored for 15 days at 10°C. The predominant spoilers, *Proteus vulgaris* and *Aeromonas hydrophila*, produced large

amounts of trimethylamine N and total volatile basic N and were radiation sensitive as indicated by  $D_{10}$  values of 8.6 and 5.4 krad respectively. *Micrococcus luteus* was relatively biochemically inert and radiation resistant, the  $D_{10}$  value being 88 krad. AS

8 R 363

Storage temperature effects on the proteolytic activity of radiation-surviving bacteria in oysters.

Liuzzo, J. A.; Farag, M. K.; Novak, A. F. *Journal of Food Science* 36 (2) 287-88 (1971) [10 ref. En] [Dept. of Food Sci., St. Univ., Baton Rouge, Louisiana 70803, USA]

The activity of 2 radiation-surviving and strongly proteolytic strains of *Pseudomonas* and *Achromobacter* were compared to the activity of 2 lesser active strains of *Neisseria* and *Bacillus* in fresh oysters during iced (32°F) and refrigerated (40°F) storage for 15 days. Radiation doses used for the oysters were 100 and 800 krad. The activity of the 2 former bacteria was higher than that of the latter 2 at both temp. and radiation doses. Neither the nonirradiated nor the irradiated uninoculated oysters displayed significant increases in proteolytic activity when they were ice-stored for 15 days, but storage at 40°F for the same period resulted in significant activity increases in the nonirradiated. This emphasizes irradiation and storage temp. as related factors. A slight decrease in pH at 15 days in both nonirradiated and 100 krad-irradiated oysters corresponded to the increase in bacterial numbers. AS

8 S 942

Effect of microbial growth upon sarcoplasmic and urea-soluble proteins from muscle.

Hasegawa, T.; Pearson, A. M.; Price, J. F.; Rampton, J. H.; Lechowicz, R. V.

*Journal of Food Science* 35 (6) 720-24 (1970) [15 ref. En] [Dept. of Food Sci., St. Univ., East Lansing, Michigan 48823, USA]

A comparison of starch gel patterns of sarcoplasmic proteins from aseptic and inoculated porcine and rabbit muscles after storage for 0, 8 and 20 days at 10°C indicated that different microorganisms preferentially utilized specific proteins. *Pseudomonas fragi* showed the greatest amount of proteolytic activity upon the sarcoplasmic fraction, causing extensive breakdown in both rabbit and porcine muscle. *Leuconostoc mesenteroides* caused extensive alteration in the sarcoplasmic proteins of rabbit muscle, but had less effect upon porcine muscle. *Pediococcus cerevisiae* exhibited similar action to *Leuc. mesenteroides* upon rabbit muscle sarcoplasmic proteins, but had no effect upon pig muscle. *Micrococcus luteus* showed only minor breakdown of rabbit muscle sarcoplasmic proteins, and had no action upon porcine muscle. Both *Ps. fragi* and *P. cerevisiae* caused considerable breakdown of the urea-soluble proteins in pig muscle and to a lesser extent in rabbit muscle.





Neither *M. luteus* nor *Leuc. mesenteroides* exerted any measurable proteolytic effect upon the urea-soluble proteins. Possible implications concerning meat spoilage are discussed. AS

8 S 943

[Studies of the microflora of prepacked sliced sausages.] Untersuchungen zur Mikroflora von vorverpackten, aufgeschnittenen Brüh- und Kochwürsten.  
Reuter, G.

Archiv für Lebensmittelhygiene 21 (12) 257-63 (1970) [20 ref. De, en] [Inst. für Lebensmittelhygiene, Freien Univ., Berlin, W. Germany]

Bacteriological examinations were made of 27 samples of vacuum-packed sliced cooked sausages and bologna sausages, followed by detailed examination of 8 manufactured batches stored at 4-6°, 10° and 20°C. and sampled at intervals up to 29 days. At 4-6°C *Lactobacilli* grew well but extensive growth of the proteolytic flora was inhibited. At 10° and 20°C the major flora comprised *Enterobacteria*, *Micrococci*, *Enterococci* and *Lactobacilli*; *Bacillus* and *Pseudomonas* spp. were not important and sulphite-reducing *Clostridia* disappeared. Egg yolk positive *Staphylococci* were 10<sup>2</sup>/g. Numbers reached in some samples included *Enterococci* 10<sup>7</sup>/g. *Enterobacteria* 10<sup>7</sup> - 10<sup>8</sup>/g and *Lactobacilli* 10<sup>8</sup> - 10<sup>9</sup>/g. Organoleptic tasting tests showed poor correlation with microbiological results. Contamination by *Enterobacteria* is attributed to slicing and packing operations and slow cooling. ELC

9 A 413

[Isolation and differentiation of pseudomonads from food.] Die Isolierung und Differenzierung von *Pseudomonaden* aus Lebensmitteln.

Kielwein, .  
Archiv für Lebensmittelhygiene 22 (2) 29-37 (1971) [22 ref. De] [St. Tierärztliche Untersuchungsamt, Aulendorf, W. Germany]

The results of a systematic examination of methods for the isolation and differentiation of *Pseudomonas* organisms are described. A glutamate/starch/phenol red medium is recommended for isolation, and a combination of the cytochrome oxidase reaction (not invariably positive) and ability to oxidize either glucose, propanol or butanol to establish the identity of the group. For further differentiation a provisional scheme of 15-16 tests is proposed which covers the organisms most likely to occur in milk, milk products, meat, meat products and fish. This scheme, tested on 1224 cultures isolated from various foods, showed *Ps. fluorescens* to predominate in milk and milk products, *Ps. putrefaciens* in meat and meat products (it also occurs in butter, whipped cream and pasteurized milk), and *Ps. aeruginosa* to comprise up to 10% of the *pseudomonads* in raw milk and milking machine washings. GTP

9 H 1285

A membrane filter technique for quantitative enumeration of *Pseudomonas aeruginosa*.

Levin, M. A.; Cabelli, V. J.

Bacteriological Proceedings 1971: 10 (1971) [En] [NEWHL, Narragansett, Rhode Island, USA]

A membrane filter procedure was developed for enumeration of *Ps. aeruginosa* in potable and recreational waters. Composition of the selective-differential medium (mPA) used, in g/100 ml of water, is as follows: L-lysine HCl, 0.5; yeast extract, 0.2 g; xylose, 0.25 g; sucrose, 0.125 g; lactose, 0.125 g; sodium thiosulphate, 0.68 g; ferric ammonium citrate, 0.08 g; and agar, 1.5 g. After autoclaving at 121°C for 15 min, 17.6 mg sulphapyridine, 0.85 mg Kanamycin, 3.7 mg nalidixic acid and 100 units of Mycostatin are added. The pH is adjusted to 7.1. After incubation at 41.5°C for 48 h, *Ps. aeruginosa* appears as a flat colony (0.8-2.0 mm diam.) with a light outer rim and a dark brown centre. This procedure was evaluated and found satisfactory as regards: recovery, working with 5 known strains of *Pseudomonas* stressed by being held in seawater; reduction in background coliform levels; and sample variability. After 48 h incubation, 92% of organisms were recovered. In addition, a 5 log reduction of background coliform level was achieved and sample variability, as estimated by D<sup>2</sup> values, was within 95% confidence limits. Recoveries using the method were greater than those obtained with current MPN methods from a variety of samples of fresh and salt water. AS

9 H 1364

[Death in newborn infants caused by *Pseudomonas aeruginosa* contaminated drinking-water.]

*Pseudomonas aeruginosa* im Trinkwasser als Todesursache bei Neugeborenen.

Weber, G.; Werner, H.-P.; Matschnigg, H.

Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, I. Originale 216 (2) 210-14 (1971) [8 ref. De, en] [Hygiene-Inst., Univ., Vienna, Austria]

10 cases of infantile mortality investigated in a small rural maternity hospital revealed that death was due to funicular septicaemia, caused by *Pseudomonas aeruginosa*. The source of infection was traced to a well which had been contaminated by a passing stream, into which large amounts of crude sewage had been discharged. Chlorination of the water supply (0.3-0.5 mg free Cl/l.) was satisfactory as a means of disinfection. Value of regular bacteriological tests using *Ps. aeruginosa* as indicator is stressed. DTD

9 M 1075

[Effect of treatments studied on microflora of cereal grains and their products.]

Janicki, J.; Chrzanowska, H.; Duma, Z.

Roczniki Technologii i Chemii Żywności 19: 5-18 (1970) [10 ref. Pl, en, de]

Contents of bacteria (with particular attention to *Pseudomonas trifolii*) and fungi (with particular attention to *Actinomyces*),





*Aspergillus*, *Penicillium* and *Candida*) at the various treatment stages in the cereals and flours described in Part I (see preceding abstr.) as well as in bran and in PVC packaged flour after storage for 4 months at room temp. are tabulated and graphically presented. It is concluded that sodium hypochlorite, chloramine and Chlorogen D at a concn. of 100 mg Cl/l. water were the most effective of the substances tested in reducing microbial contamination of grain. Sodium hypochlorite at 50 mg Cl/l. water was almost as effective and, with regard to economic reasons, is recommended as optimal. Contamination of flour as % of that of treated grain before milling was: bacteria, 15-37; Actinomycetales, 22-31; and fungi, 48. Storage of flour resulted in marked decrease in microbial contamination. SKK

#### 9 P 1460

[Microbiology of milk at low temperatures.]

Nordlund, J.

Karjantuntti 54 (2) 40-45 & 47 (1971) [54 ref. Fi]

[Valion, Lab., Helsinki, Finland]

Characteristics of psychrotrophic bacteria in milk are reviewed. In the Valio laboratory, microbiological procedures have been developed for the modern requirements of milk product cleanliness, the technical applicability of improvement measures and hygiene aspects. Initial experiments have shown that the major psychrotrophs responsible for deterioration of milk are Gram-negative, non-sporeforming bacilli, particularly pseudomonads. The coli-bacteria which are indicative of hygiene contamination are comparatively resistant to penicillin. All the penicillin-resistant micro-organisms in milk appeared to be alien and more or less pathogenic. [See also FSTA (1971) 3 5P791.] NK

#### 9 P 1461

[A study of the proteolytic activity of *Pseudomonas ichthyosmia* in milk.]

Godbille, H.

Lait 51 (503/504) 203-05 (1971) [Fr]

The test milk contained (/l.) 3.776 g total N, 0.177 g trichloroacetic acid (TCA)-soluble N, 0.236 g amino N, and 1.452 g lactic acid. After 6 samples of this milk had been inoculated with 1% of a 14-day culture of *Pseudomonas ichthyosmia* and incubated for 1 and 11 days respectively, composition was as follows: TCA-soluble N, 1.826 and 4.109 g/l.; amino N, 0.368 and 1.408 g/l.; and lactic acid, 2.8 and 2.655 g/l. Lactic acid concn. reached a peak (3.388 g/l.) after 2 days' incubation. When milk inoculated with *Ps. ichthyosmia* was incubated at 37, 45 or 60°C, proteolytic activity was greatest at 60°C after incubation for 1 day, at 45°C after incubation for 2 days and at 37°C after incubation for 3 days. CDA

#### 9 P 1462

Ester production by *Pseudomonas fragi*. IV. Demonstration of esterase activity.

Reddy, M. C.; Lindsay, R. C.; Montgomery, M. W. Applied Microbiology 20 (4) 555-57 (1970) [7 ref.

En] [Dept. of Food Sci. and Tech., St. Univ., Corvallis, Oregon 97331, USA]

2 strains of *Ps. fragi*, isolated from pasteurized milk, as described earlier [J. Dairy Sci. (1968) 51 (5) 656-59], were incubated in 1% peptone broth for 4 days at 7°C then harvested by centrifugation. Manometric measurement of esterase activity of culture supernatants, whole cell suspensions, and cell-free extracts obtained by ultrasonic disruption of washed bacterial cells, showed the esterases to be intracellular. 6 bands of esterase activity were demonstrated by polyacrylamide gel electrophoresis; 1 band exhibited slow, 3 moderate and 2 rapid mobility. Differences between the specificities of the 6

activity bands were observed when  $\alpha$ -naphthyl acetate,  $\alpha$ -naphthyl butyrate and  $\alpha$ -naphthyl propionate were used as substrates. It is concluded that the esterases of *Ps. fragi* differ in their specificity towards the acyl side chain of substrates. [See FSTA (1970) 2 4P432 & (1969) 1 12P1244 for parts II and III respectively.] CDA

#### 9 P 1465

[Report on the detergent-disinfectant 'Neomoscan M'] Untersuchungsbericht über das kombinierte Reinigungs- und Desinfektionsmittel 'Neomoscan M'. Hoffer, H.

Milchwirtschaftliche Berichte aus den Bundesanstalten Wolfpassing und Rotholz 1970 (25) 283-84 (1970) [De]

Neomoscan M is a light yellow liquid, consisting of a mixture of alkali, phosphates and active organic Cl, which is used in 0.3-0.5% concn. at 40-50°C. Corrosion tests (0.5% solution at 60°C for 48 h) on Böhler-Antinit steel, Fe, Cu, brass and 'Dekoral T' revealed a little darkening of Cu and brass and some etching of iron. Plastics tubing, sight glasses and teatcup liners were also tested at 45°C for 48 h. It is considered that there is no undesirable action on any of the materials tested and Neomoscan M is recommended for use in the dairy industry. There was no detectable growth of

*Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus faecalis* or *Geotrichum candidum* after a contact time of 5 and 2½ min at 20 and 40°C respectively, with 0.25-1% solution. OA

#### 9 R 404

Use of gas chromatography and mass spectrometry for the identification of fish spoilage bacteria. Levin, R. E.; Chen, T. C.; Nawar, W. W. Bacteriological Proceedings 1971: 3 (1971) [En] [Dept. of Food Sci. and Tech., Univ., Amherst, Massachusetts, USA]

2 major high boiling volatile compounds produced during refrigerated storage of haddock were identified as phenylethanol and phenol. Members of the *Achromobacter-Moraxella* group were found singularly unique in their ability to produce significant amounts of phenylethanol in vitamin-free casein hydrolysate broth and from L-





phenylalanine and ethanol. Phenol was produced solely from L-tyrosine by an aeromonad from haddock. The enzyme responsible for phenol production has been purified 80-fold and found to require pyridoxal phosphate. AS

#### 9 S 1114

Effects of four species of bacteria on porcine muscle. I. Protein solubility and emulsifying capacity.

Barton R. J.; Bratzler, L. J.; Price, J. F. *Journal of Food Science* 35 (6) 779-82 (1970) [19 ref. En] [Dept. of Food Sci., St. Univ., East Lansing, Michigan 48823, USA]

Aseptic porcine muscle was inoculated with (i) *Pediococcus cerevisiae*, (ii) *Micrococcus luteus*, (iii) *Leuconostoc mesenteroides* and (iv) *Pseudomonas fragi* and compared with aseptic controls during 20 days storage at 2 and 10°C. All organisms grew at 10, but only (iv) and (iii) at 2°C. Solubilities of protein fractions were affected by inoculation. This was exemplified by correlation coeff. of -0.37 to +0.50. Coeff. indicated the interrelationship affected by storage conditions and bacterial growth. Protein solubility studies revealed a loss in water-soluble fraction during storage of controls and (ii)- and (iii)-treated samples. Samples with (iv) evidenced initial loss, followed by an increase. Solubility of meat proteins in salt solution increased during the first 8 days, then decreased or remained relatively constant for all samples. In comparison with controls, samples with (iv) increased in salt-soluble protein solubility during the first 8 days, whereas those with (iii) decreased during the latter part of storage. Insoluble protein increased except for (iv)-inoculated samples, which decreased. Nonprotein nitrogen (NPN) increased for all treatments and controls over 20-days. NPN extracted from samples inoculated with (iv) increased greatly. pH increased with growth of (ii) and (iv) and decreased with growth of (i) and (iii). Emulsifying capacity was not influenced by growth of (ii) or (i); emulsifying capacity of samples inoculated with (iii) decreased, that of samples inoculated with (iv) increased. AS

#### 9 S 1115

Effects of four species of bacteria on porcine muscle. II. Electrophoretic patterns of extracts of salt-soluble protein.

Barton, R. J.; Bratzler, L. J.; Price, J. F. *Journal of Food Science* 35 (6) 783-86 (1970) [5 ref. En]

Electrophoresis of 0.6 M KCl extracts of porcine longissimus dorsi muscle revealed little change in the type or number of protein bands found either by starch-urea or disc-urea gel electrophoresis. The 0.6 M KCl extracts of muscle samples inoculated with *Pediococcus cerevisiae*, *Leuconostoc mesenteroides* and *Micrococcus luteus* and stored at 2 and 10°C for 20 days did not differ electrophoretically from control samples. Extracts of samples inoculated with *Pseudomonas fragi* showed a loss in the number of protein bands on starch-urea gel and disc-urea gel

electrophoresis, indicating this organism exhibited some proteolytic effect upon the myofibrillar proteins. AS

#### 9 S 1122

Chemical and organoleptic changes in poultry meat resulting from the growth of psychrophilic spoilage bacteria at 1°C. I. Introduction and changes in free amino acids.

Lea, C. H.; Stevens, B. J. H.; Smith, M. J. *British Poultry Science* 10 (3) 203-17 (1969) [31 ref. En] [Agric. Res. Council, Food Res. Inst., Colney Lane, Norwich, NOR 70F, England]

Samples of aseptically minced chicken breast and leg muscle were inoculated with microorganisms associated with spoilage of chill stored chicken to give initial counts of  $10^4$ - $10^5$  organisms/g. Organisms studied were *Pseudomonas putrefaciens*, a pigmented *Pseudomonas*, and spp. of *Acinetobacter* and *Aeromonas*, in pure or mixed culture. Samples were stored at 1°C and examined when counts reached  $10^6$  and  $10^8$ - $10^9$ /g. Controls comprising aseptically prepared muscle treated with antibiotic were used to separate changes due to normal autolysis from microbiological changes. Changes resulting from microbiological growth were smaller than the effect of autolysis at counts up to  $10^8$  organisms/g (6-9 days). Neither autolysis nor microbiological growth for 9 days caused pH changes in breast muscle, but pH rises occurred in leg muscle; when counts reached  $10^9$ /g increased pH occurred, especially with mixed cultures. Autolysis liberated amino acids but bacterial action destroyed them, the ultimate effect being decreased amounts of amino acids although the total effect of the microorganisms was quite small. Effects on flavour were difficult to assess; concn. of neither taurine (the predominant amino acid) nor glutamic acid was much affected by autolysis or bacterial action, while these tended to balance for other amino acids. [See also following 5 abstracts]. -ELC

#### 9 T 474

Xanthan gum.

Rocks, J. K.

*Food Technology* 25 (5) 476-77, 480, 482 & 485 (1971) [En] [Kelco, Co., 8225 Aero Dr., San Diego, California 92123, USA]

Xanthan gum is a new hydrophilic colloid approved by FDA for use in foods. It is produced by fermentation of glucose by *Xanthomonas campestris*. Its aqueous solution is pseudoplastic in nature, behaving as a solid until a min. shear force is reached and as a liquid above that min. It maintains its viscosity regardless of temp. and pH changes, and it has good compatibility with salts. It reacts with locust bean gum to form a thermoreversible gel. This gel tends to have the same stability pattern as xanthan gum. Xanthan gum's unusual properties make it suitable for a wide variety of food applications (e.g. for syneresis control in starch puddings, as stabilizer in salad dressings, for prevention of fat separation in canned meat products). -IFT





10 B 93

Some lipolytic psychrophilic *Pseudomonas* bacteria and their hydrolysis of edible fats. [A thesis] Björklund, A.  
Valtion Teknillinen Tutkimuslaitos Julkaisu 156: 84pp. (1970) [Numerous ref. En] [St. Inst. for Tech. Res., Otaniemi, Finland]

Refrigerated and frozen retail store food was studied for psychrophilic bacteria, the highest numbers being found in minced meat ( $10^5$ - $10^6$ /g) and frozen fish ( $10^4$ - $10^5$ /g). Enrichment of the psychrophilic bacteria of the samples enabled a large number of lipolytic strains to be detected, including a high number of *Pseudomonas* spp. Lipolytic strains found in frozen ham were not pseudomonads. The mechanics of lipolysis of *Pseudomonas fluorescens*, *Ps. fragi* and *Ps. putrefaciens* are discussed. Tests on various products showed that the order of lipolysis was tributyrin > coconut oil > olive oil > butterfat > beef tallow. Lipolysis of tributyrin, beef tallow and coconut oil was examined during storage with *Pseudomonas* lipase. Enzymic lipolysis was reduced below 0°C until at -20°C and below hardly any enzymic hydrolysis took place, chemical hydrolysis occurring instead. JEP

10 B 100

[Studies of the lipolytic activity of microorganisms of importance to food hygiene.] Untersuchungen zur lipolytischen Aktivität lebensmittelhygienisch wichtiger Bakterienarten. Scheibner, G.  
Monatshefte für Veterinärmedizin 25 (16) 624-629 (1970) [6 ref. De, en, ru] [Sektion Tierproduktion und Veterinärmed., Humboldt-Univ., Berlin, Germany]

The lipolytic activity of 261 strains of microorganisms of importance to food hygiene was examined. Species of *Bacillus*, *Staphylococcus*, *Micrococcus*, *Proteus*, *Pseudomonas*, *Achromobacter* and *Aeromonas* and yeasts were found to be lipase-formers. Substrates examined included lard, tallow, butter and herring oil. Lipase activity of the organisms depended on temp., pH and composition of the substrate. The necessity for hygienic preparation of fats and fatty foods to avoid lipolysis by lipase-forming microorganisms is emphasized. IN

10 C 174

Factors affecting the production of bacterial food poisoning toxins. [A lecture] Baird-Parker, A. C.  
Journal of Applied Bacteriology 34 (1) 181-197 (1971) [107 ref. En] [Unilever Res. Lab., Colworth House, Sharnbrook, Bedford, UK]

This is a review of some of the most recent information relating to factors affecting the formation of food-poisoning toxins by bacteria growing in foods and laboratory media. Food-poisoning toxins discussed include those formed by *Staphylococcus aureus*, *Clostridium botulinum*, *Clostridium perfringens*, *Pseudomonas cocovenenans*, *Vibrio parahaemolyticus* and *salmonellae*. AS

10 J 1239

Bacteria associated with the fishy fermentation of olives. Meyer, M. T.; Vaughn, R. H.  
Bacteriological Proceedings 1971: 19 (1971) [En] [Univ., Davis, California, USA]

An unusual spoilage of olives known as fishy fermentation occurs infrequently, particularly in olives processed by the green-ripe method. Affected olives smell and taste of stale fish. Bacteria which produce the fishy odour have been isolated from spoiled commercial olives. The bacteria comprise 5 genera: *Achromobacter*, *Aerobacter*, *Aeromonas*, *Paracolibacterium*, and *Pseudomonas*. It was suspected that the defect resulted from decomposition of olive oil. However, most, but not all the cultures producing the fishy odour are lipolytic. This suggests at least 2 precursors for the fishy odour. AS

10 R 419

Bacteria active in the spoilage of certain sea foods. Herbert, R. A.; Hendrie, M. S.; Gibson, D. M.; Shewan, J. M.  
Journal of Applied Bacteriology 34 (1) 41-50 (1971) [48 ref. En] [Torry Res. Sta., 135 Abbey Road, Aberdeen AB9 8DG, UK]

Spoilage of certain sea foods is caused by the activities of some groups of Gram-negative bacteria. The characteristic off-odours and -flavours of naturally spoiling cod and haddock have been reproduced in blocks of sterile cod muscle by organisms identified as *Pseudomonas putida*, *Ps. fragi*, *Ps. putrefaciens* and other *Pseudomonas* spp. AS

10 R 434

Bacteriological aspects of fish protein concentrate production. Goldmintz, D.; Hull, J. C.  
1416cb 11: 335-340 (1969, publ. 1970) [5 ref. En] [Nat. Center for Protein Concentrate, Bureau of Commercial Fisheries, College Park, Maryland, USA]

This paper was presented at the 26th General Meeting of the Society for Industrial Microbiology held at Burlington Vermont in Aug. 1969. Raw hake and menhaden and fish protein concentrate (FPC) made from them were examined for total numbers and types of bacteria. Fish of the 2 spp. with counts as high as  $10^5$  cells/g yielded FPC with very low bacterial populations. *Flavobacterium* and *Pseudomonas* were predominant in the raw fish, whereas *Bacillus* was predominant in the FPC. The organisms in the final product may have come through the processing, but they more probably come from cross-contamination, either from the raw fish or from the environment. Environmental surveys revealed that isolation of plant facilities effectively controlled Gram-negative cross-contamination when the plant was cleaned frequently. AS





10 S 1209

[Spoilage of Greek sausages.]

Georgakis, S.

Ellenike Kteniatrike 12 (4) 184 (1969) [Gr]

8 types of sausage spoilage are presented, these are attributed to: growth of microorganisms such as *Bacillus mesentericus viscosus*, *Serratia marcescens*, *Bacterium violaceum*, *Bacterium phosphorescens*, *Photobacterium luminisum*, *Saccharomyces*, cocci, moulds and parasites; high concentrations of carbohydrates, NaCl, and  $\text{Na}_2\text{HPO}_4$ ; and use of unsuitable raw materials. Conditions favouring sausage spoilage are briefly described. NM

11 H 1737

Oider science. A review of some valuable work recently carried out in Britain. Anon.

International Bottler and Packer 45 (7) 25-26 (1971) [En]

A brief account is given of work at the Long Ashton Res. Sta. (National Fruit & Cider Inst.), based on its 1970 report. The types of bacteria in apples to be used for cider making in England and France have been surveyed. Ciders with and without  $\text{SO}_2$  were examined and it was found that homofermentative bacteria had disappeared but the heterofermentative rods and cocci survived. It was also found that the bacteria levels in second pressings from cider pulp are significantly higher than in first pressings. The bacteria were isolated for identification and a motile organism that produces gas was discovered, with characteristics resembling the "cider sickness" organism called *Zymomonas anaerobia* var. *pomaceae*. Current methods of cider manufacture prevent development of the organism, but any change that may occur in the cider industry involving the storage of sweet, low-acid ciders must be monitored to prevent proliferation of the organism. DBC

11 P 1856

Psychrotrophic micro-organisms in butter. A review. I & II.

Thomas, S. B.; Druce, R. G.

Dairy Industries 36 (2) 75-80; (3) 145-150 (1971) [100 ref. En, fr, de, es]

In the 1st part of this review, effects of bulk milk collection on butter quality, sources of psychrotrophic microorganisms in fresh butter, and incidence of psychrotrophs and their enumeration in butter are discussed. The 2nd part deals with the psychrotrophic microflora, particularly *Pseudomonas*, *Acinetobacter* and *Aeromonas* spp., and defects caused by these organisms, including putrid, surface, cheesy and other taints, rancidity, bacterial surface discoloration, and mould discoloration. CDA

11 C 213

[Test report on 'Gloquat C' disinfecting agent.]

Untersuchungsbericht über das Desinfektionsmittel "GLOQUAT C".

Hoffer, H.

Milchwirtschaftliche Berichte aus den Bundesanstalten Wolfpassing und Rotholz 1971 (27) 171-172 (1971) [De] [Bundes-Lehr- und Versuchsanstalt für Milchwirtschaft, Wolfpassing, Austria]

Characteristics of 'Gloquat C' disinfecting agent, consisting of alkylaryltrimethylammonium chloride, water and isopropyl alcohol, are listed. Corrosion tests with a 0.05% 'Gloquat C' solution at 30°C showed that Böhler-Antinit steel AS2W, iron, tin-plated iron, copper, brass,

Dekoral T and aluminium [99.5% purity] surfaces withstood satisfactorily 48-h exposure. A 0.05% solution of 'Gloquat C' effected in 2.5 min at 70°C or in 5 min at 20°C total kill of a suspension of *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus faecalis* and *Mycobacterium phlei*. Practical tests of 'Gloquat C' were carried out over 2 months at the Wolfpassing Institute dairy. It is concluded that 'Gloquat C' as 0.05% solution is suitable for disinfection at room temp. of walls, floors, and outside of containers and equipment in the dairy industry. SKK

11 P 1872

Sublethal heat treatment and recovery of psychrophilic bacteria.

Dabbah, R.

Dissertation Abstracts International. Section B. The Sciences and Engineering 31 (11) 6774: Order no. 71-12173 (1971) [En] [Univ., College Park, Maryland, USA]

A psychrotrophic *Pseudomonas* sp., isolated from commercially pasteurized milk, could not be recovered on trypticase soya agar when plated immediately after heat treatment at 55°C for 30 min [heating medium unspecified]. However, when the heated bacteria were held in trypticase soya broth for 48-72 h at 20°C or 2-3 wk at 4°C, some cells recovered the ability to grow normally. Heat resistance and recovery of the bacteria were affected by their physiological state, by the nature of the heat treatment and by the recovery medium. Recovery was favoured by more complex heating media including milk whey. It is concluded that primary involvement of the respiratory





system in heat injury and recovery of bacteria is unlikely, but that the catalase system may play a role. [See also J. Dairy Sci. (1968) 51 (6) 927.] CDA

## 11 R 458

Behaviour of the Gram-negative bacteria in lyophilized tissues of fish meat.

Zaleski, S.; Zmyslowska, I.

Acta Microbiologica Polonica Series B: Microbiologia Applicata 20 (1) 35-41 (1971) [9 ref. En, pl] [Coll. of Agric., Fac. of Marine Fishery, Dept. of Microbiol., Szczecin, Poland]

Cod, Norway haddock and red porgy fish tissue were minced and inoculated with either *Achromobacter*, *Flavobacterium* or *Pseudomonas* and incubated 48 h at 20°C. After lyophilization, samples were stored in CO<sub>2</sub>, N<sub>2</sub> or air at room temp. In a 2nd investigation, minced cod was inoculated simultaneously with all combinations of 2 bacterial strains of *Achromobacter*, *Anitratum*, *Pseudomonas* and *Vibrio*, and then treated as above. Bacteria were determined quantitatively by plating on 2.5% agar medium or qualitatively during the experiment. Single bacterial strains at a level of 10<sup>7.7</sup>-10<sup>14</sup>/g meat decreased to zero between the 12th and 30th day of storing, except for *Achromobacter* in cod which survived 60 days in air and 45 days in CO<sub>2</sub> and N<sub>2</sub>. Survival time of bacteria was much longer when introduced in a combination of 2 strains. (36-70 days). Survival curves are shown. 98-99.9% of microorganisms were destroyed during lyophilization. PEG

## 11 R 473

Studies on the bacterial origin of certain volatile aromatic compounds in refrigerated haddock.

Chen, T.-C.

Dissertation Abstracts International. Section B. The Sciences and Engineering 31 (11) 6674: Order no. 71-11441 (1971) [En] [Univ., Amherst, Massachusetts, USA]

2 volatile aromatic compounds, phenol and phenethyl alcohol, were isolated from haddock fillets and samples of cod and flounder, and identified using gas chromatography and mass spectrometry. Phenethyl alcohol was produced by strains of *Moraxella*, *Flavobacterium*, and some *Pseudomonas* from fishery sources. Marine *Moraxella* were readily differentiated from other fishery organisms by the production of relatively large amounts of phenethyl alcohol, detected by gas chromatography of ether extracts of 0.5% vitamin-

free casein hydrolysate culture broth. Results indicated that phenethyl alcohol was produced by deamination of phenylalanine, with phenylpyruvate as a possible intermediate, which then reacted with ethanol. A phenol producing organism, which was designated as *Aeromonas phenologenes*, a new species, was isolated from haddock fillet. Tyrosine was found to be the immediate precursor for phenol formation, with p-hydroxyphenyl pyruvate as a possible intermediate. A new enzyme, designated tyrosine phenol-lyase, could be precipitated from sonicated

cell preparations of the new species with 5% (w/v) ammonium sulphate, and purified with acetone. The enzyme had an optimum pH range 8.0-8.5, was denatured by heating at temp. >60°C for 10 min, and converted tyrosine directly to phenol. Pyridoxal phosphate was required for activity, and an increase in activity by addition of EDTA or sodium arsenate was observed. ATP and oxalic acid inhibited activity in crude preparations. WM

## 11 R 474

[Selective culturing of *Pseudomonadaceae* obtained from fish product.]

Spreekens, K. J. A. van

Voedingsmiddelentechnologie 2 (21) 12-16 (1971) [19 ref. Nl] [Inst. voor Visserijprodukten TNO, Ijmuiden, The Netherlands]

Samples for testing were obtained from shelled shrimps, fish-filleting tables, pre-packed cod fillets, and fish waste. The isolated bacteria which were motile, cytochrome oxidase positive, Gram-negative rods able to oxidize glucose, were considered to be *Pseudomonadaceae*. Most of the glucose-negative strains of this group which were shown to liquefy gelatine and produce H<sub>2</sub>S, were also included in the same genus. An ammonium lactate-crystal violet medium had limited application since *Acinetobacter* were also detected, whereas satisfactory results were obtained for the selective culture of glucose-oxidizing strains of *Pseudomonas* using glutamate-penicillin or arginine-chloramphenicol media prepared in diluted sea-water. 88% of H<sub>2</sub>S-forming bacteria isolated on thiosulphate-ferrosulphate agar were composed of glucose-negative strains of *Pseudomonas*. Initial selection on the basis of motility using semi-solid nutrient or glucose-bromocresol purple agar, followed by other tests, proved to be the most suitable method for selective culture of all strains of *Pseudomonas*. WLC

## 11 S 1356

Microbiological and colour changes during ageing of beef.

Ledward, D. A.; Nicol, D. J.; Shaw, M. K. Food Technology in Australia 23 (1) 30-32 (1971) [18 ref. En] [CSIRO, Div. of Food Preservation, Meat Res. Lab., Cannon Hill, Queensland 4170, Australia]

Effects of varying O<sub>2</sub> and CO<sub>2</sub> concn. on the growth of spoilage organisms at 36°F on beef semitendinosus muscle were investigated under conditions of min. wt. loss. Wt. loss was minimized by vacuum packing the meat in Cryovac or using moisture impermeable films of MSADT-80 or polyethylene. Under vacuum packaging, the equilibrium atm. was found to consist of 1-2% O<sub>2</sub> and 15-20% CO<sub>2</sub>; growth of *Pseudomonas* was inhibited and the slower growing *Microbacterium* was the predominant spoilage organism. With controlled atmospheres, greatest bacterial inhibition was obtained by reducing the O<sub>2</sub> concn. to 0.2% in the presence of 25% CO<sub>2</sub> when *Lactobacillus* type 58 predominated. Meat colour was adversely affected when stored under O<sub>2</sub> concn. <5% and CO<sub>2</sub> concn. >25%. It is concluded that an atm. of 5% O<sub>2</sub> with elevated CO<sub>2</sub> levels (up to 25%) provides adequate microbiological and colour control of beef during ageing at 36°F. AH





12 B 131

Temperature cycling effects on bacterial growth. I. *Pseudomonas fluorescens*.

Howell, A. J.; Saffle, R. L.; Powers, J. J. *Journal of Food Science* 36 (5) 778-780 (1971) [14 ref. En] [Dept. of Food Sci., Univ., Athens, Georgia 30601, USA]

Although temp. occurring in nature are constantly fluctuating, virtually all research involving temp. effects on organisms has been carried out at constant temp. An investigation was made to determine the effect mild cycling of temp. has on certain species of bacteria. The effect of constant and cycled-up or cycled-down temp. was determined for *Ps. fluorescens*. A thermal gradient-bar proved to be a rapid, efficient method for determining these effects, affording a wide range of temp. with only a few degrees difference between 2 consecutive temp. Cycling effects appeared to be dependent upon the organism and whether or not the temp. was above or below the optimum growth temp. In general, the cycled-down growth responses appear to be greater than those for the cycled-up responses. At temp. both above and below the optimum, the cycled-down organisms produced greater growth responses than the cycled-up organisms. The constant values are only a small amount greater than the cycled-down values. AS

12 C 234

Isolation of *Escherichia coli*, *Pseudomonas aeruginosa*, and *Klebsiella* from food in hospitals, canteens, and schools.

Shooter, R. A.; Faiers, M. C.; Cooke, E. M.; Breaden, A. L.; O'Farrell, S. M. *Lancet* 1971-II (7721) 390-392 (1971) [7 ref. En] [Dept. of Bact., St. Bartholomew's Hospital, London EC1, UK]

Since faeces are thought to be a source of bacteria responsible for urinary tract and other infections, the origin of the faecal flora is of some importance. In order to examine the hypothesis that Gram-negative bacilli may be present in food in numbers sufficient to colonize the bowel, food in 8 hospitals, 11 canteens and 2 schools were examined for *E. coli*, *Ps. aeruginosa*, *Klebsiella* spp. and *Proteus* spp. Taps, sinks, washing-up water, slicing machines, etc. were also examined. Foods examined included salads, cold meat, cold sweets, hot food, pureed food and milk feeds. There was variation in isolation from place to place. *Proteus* was isolated from only one sample (cold meat). Contamination with one or more of the other organisms was found in all samples, salads being the most and hot food the least frequently contaminated. From the results it is concluded that there is a possibility that, from time to time, food might contain sufficient of these organisms to lead to establishment in the bowel. The origin of the bacteria in the canteens, etc. is thought to be incoming food such as meat. [See also FSTA (1970) 2 8C188 & 11C242.] PET

12 P 2017

[Liquid milk in the German Federal Republic from the viewpoints of bacteriology, biochemistry and pesticide residue contents.] *Trinkmilch in der Bundesrepublik Deutschland: Ihr bakteriologischer, biochemischer und rückstandsanalytischer Status*. Tolle, A.; Heesch, W.; Reichmuth, J.; Kind, H. *Milchwissenschaft* 26 (7) 401-410 (1971) [15 ref. De, en] [Inst. für Hygiene, Bundesanstalt für Milchwissenschaft, Kiel, W. Germany]

This inquiry into the quality of W. German pasteurized market milk, carried out in the winter of 1969/70 and summer of 1970 was a continuation of the 1968 raw milk study [see Tolle et al., *Kieler milchw. ForschBer.* (1968) 20 (4) 349-94] and involved ~2000 milk samples (about equally divided between winter and summer) from 14 supply areas including the 12 covered in 1968. 15 bacteriological and 20 biochemical (Auto-Analyser) criteria were determined and correlations between them were determined as well as contents of antibiotic residues and organochlorine pesticide residues (in every 5th sample). Results are tabulated and (for each area) graphically presented. The salient results and conclusions were: no pathogens were detected; the relatively frequent appearance of *Pseudomonas aeruginosa* (in 8.5% of winter and 37.7% of summer samples) requires further attention; marked variations (by a factor of  $\leq 10^4$ ) in saprophyte contents of the milks were found between areas, seasons and between bulk and packaged milks; no antibiotic residues were detected and those of organochlorine pesticides were mostly well below the tolerance levels. SKK

12 R 519

The bacteriological of 'scampi' (*Nephrops norvegicus*). II. Detailed investigation of the bacterial flora of freshly caught samples.

Cann, D. C.; Hobbs, G.; Wilson, B. B. Horsley, R. W. *Journal of Food Technology* 6 (2) 153-161 (1971) [38 ref. En] [Torry Res. Sta., PO Box No. 31, 135 Abbey Road, Aberdeen, AB9 8DG, UK]

49 samples of freshly landed *Nephrops norvegicus*, from 13 ports of landing, were examined bacteriologically. Total viable counts ranged from  $3.55 \times 10^3$ /g to  $2.25 \times 10^6$ /g at 20°C and  $3 \times 10^1$ /g to  $2.73 \times 10^6$ /g at 37°C. Coryneform organisms were predominant in the bacterial flora with strains of the *Achromobacter-Acinetobacter* group and the *Pseudomonas*, *Cytophaga* and *Micrococcus* genera also present. [See FSTA (1971) 3 11R487 for part I.] AS

12 S 1395

[Increasing the keeping quality of chilled meat using ultraviolet rays.] *Verlängerung der Haltbarkeit von Kühlfleisch durch ultraviolette Bestrahlung*.

Kaess, G. *Kältetechnik-Klimatisierung* 23 (4) 111-113 (1971) [11 ref. De, en, fr] [CSIRO, Div. of Food Preservation, Meat Res. Lab., Brisbane, Australia]

The intensity of UV rays necessary for a substantial inhibition of the growth of microorganisms on chilled meat was established.





Sterile slices of cow semitendinosus muscle (0.15 cm thick and 7.5 cm in diam.) were sprayed with pure cultures of a *Pseudomonas* strain, a yeast strain and a *Thamnidium* or *Penicillium* strain. 4 irradiated and 4 non-irradiated slices of meat were stored at 0°C and 99.3 and 98.7% RH. The treated samples were continuously irradiated with 0.2, 2.2 or 24  $\mu\text{W}/\text{cm}^2$  of UV-light ( $\lambda = 254 \text{ nm}$ ). The influence of the light-intensities on the development of the microorganisms was studied. It was found that UV-light of 0.2  $\mu\text{W}/\text{cm}^2$  extended the lag-phase of the growth curve of bacteria, decreased the number of cells in the lag phase and reduced colony numbers in the stationary phase. The moulds treated with 0.2  $\mu\text{W}/\text{cm}^2$  developed a normal mycelium, after an initial retardation. To prevent both the bacterial growth and the development of a mycelium of moulds, a UV-intensity of 2  $\mu\text{W}/\text{cm}^2$  was necessary. MDB

## 12 S 1516

Extending storage life of chilled mutton by continuous irradiation with ultraviolet light. Kaess, G.; Weidemann, J. F.

Food Technology in Australia 23 (2) 62-64 & 66 (1971) [12 ref. En] [CSIRO Div. of Food Preservation, Meat Res. Lab., Cannon Hill, Queensland 4170, Australia]

Pilot-scale expt. are described, to determine the effects of continuous UV irradiation on microbial development on chilled mutton carcasses, and the extent of the increase in storage life. A cold room was subdivided into 2 equal compartments, 1 of which contained a lamp emitting UV light  $\sim 253.7 \text{ nm}$ . The control compartment contained an incandescent lamp of equal wattage to balance heat input. 5 mutton carcasses were hung in each room and pieces 3 in. diam. and  $\frac{1}{2}$  in thick were removed and replaced with inserts of beef which had been sprayed with a suspension of *Pseudomonas* sp. 1482, lag periods at 94% 37°F was maintained. The RH was maintained by

steam injection at 90% for the first 3 expt. and 94% for the remainder. Bacteriological samples were taken at intervals of 2-4 days. The inhibitory effects of continuous UV irradiation seemed to be due to an extended lag phase, a reduced growth rate, and a lower level of the stationary phase. Increasing the RH from 90-94% had no effect on lag periods, but growth rates were slightly smaller and stationary levels rose. An UV light fitted with a metal shield was less effective than direct irradiation. With *Pseudomonas* sp. 1482, ag periods at 94% RH were significantly shorter than at 90% RH, but the growth rates and the level of the stationary phase were not influenced. Gram negative rods were the main spoilage flora at RH 94%, and this was much reduced by UV light. Gram negative diplococci were the dominant group at 90% RH in 3 out of 5 expt. and were less affected by irradiation. In the remaining 2 expt. yeasts were predominant and were unaffected by UV light. At the end of storage, the areas directly affected by UV light showed only small colonies of microorganisms. These were more frequent

on the shaded sides. Patches of *Mucor* and *Penicillium* appeared on the outsides of the control carcasses. In general, the storage life of the mutton exposed to UV light was 1.5-2  $\times$  that of the controls. IFlaC

## Volume 4

### 1 C 5

Bacterial production and destruction of histamine in foods, and food poisoning caused by histamine. [A review]

Ienistea, C.

Nahrung 15 (1) 109-113 (1971) [74 ref. En] [Inst. for Hygiene and Public Health, Bucharest, Roumania]

This review briefly covers the occurrence, heat stability, bacterial formation and destruction, and relation to food poisoning of histamine. The effect of environmental conditions on histidine decarboxylase activity is shown and the optimum pH is stated to be 5.0-5.5 for most organisms. Histaminase activity may be identical with diamine oxidase activity shown by such organisms as *Pseudomonas aeruginosa*, *Escherichia coli*, *Proteus vulgaris*, *Serratia marcescens*, *Sarcina flava* and *Clostridium fesiari*. The optimum pH for histamine destruction is 7.0. Statistics relating to the occurrence of food poisoning caused by histamine are given and it is stated that histamine-forming strains of *E. coli* and *Cl. perfringens* may cause enteritis and summer diarrhoea in children. ARA

### 1 H 183

Zymomonas and acetaldehyde levels in beer.

Dadds, M. J. S.; Macpherson, A. L.; Sindclair, A. Journal of the Institute of Brewing 77 (5) 453-456 (1971) [13 ref. En] [Allied Breweries Process Res. Dept., 107, Station Street, Burton on Trent, UK]

High acetaldehyde levels in beers during processing were found to be due to infection with *Zymomonas anaerobia*. Acetaldehyde only appeared in the absence of yeast and the level was correlated with the concn. of *Z. anaerobia* as determined by the time taken to produce  $\text{H}_2\text{S}$  in a primed beer forcing test. AS

### 1 H 185

Gastric erosions caused by home-brewed lager.

O'Keane, M.; Smith, S.; Goldberg, A.

Lancet 1971-II (7728) 795-797 (1971) [3 ref. En] [Univ. Dept. of Materia Medica, Stobhill General Hospital, Glasgow N1, UK]

A 22 yr old man was admitted to hospital because of melaena due to acute gastric erosions. In the 3 wk before his admission he had drunk several gal of home-brewed lager. Investigations revealed that this was contaminated with traces of acetaldehyde and acetic acid which had been produced from ethanol by *Acetobacter*





melanogenus infection present in the yeast. Experiments were carried out on the effect of 'home-brewed' lager and beer on the stomachs of guinea pigs; the incidence of erosive gastritis was significantly greater when the animals were given home-brewed lager. AS

1 H 187

Discovery of the "cider sickness" bacterium *Zymomonas anaerobia* in apple pulp.

Carr, J. G.; Passmore, S. M.

Journal of the Institute of Brewing 77 (5) 462-466 (1971) [19 ref. En] [Long Ashton Res. Sta., Univ., Bristol, UK]

After a lapse of nearly 20 yr the "cider sickness" organism has been rediscovered. On this occasion it was found in apple pulp, this being the first time it has been isolated from a source other than "sick cider". In spite of its presence in the pulp, no outbreak of the disorder occurred in the factory from which it was isolated, thus reaffirming the soundness of cider-making methods specifically designed to prevent growth of this bacterium. Characteristics of this isolate are compared with the 2 known species, namely, *Zymomonas anaerobia* and *Z. mobilis* and it is concluded that the new isolate is a strain of the former. AS

1 P 13

[The influence of liquid nitrogen freezing on the microflora of fresh milk.]

Giroux, R. N.; Martin, C.; Samson, R.

Canadian Institute of Food Technology Journal 4 (2) 55-57 (1971) [3 ref. Fr, en] [Service de l'Industrie Laitiere, La Cooperative Agricole de Granby, C.P. 219, Granby, Quebec, Canada]

Changes in the microflora of raw milk were determined during frozen storage for 5 months in liquid N<sub>2</sub>. The milk was stored in 1-ml plastics capsules and tested after 0, 1 and 14 days and 5 months, 6 capsules being examined on each occasion. Mean total count increased from 1.157 million to 2.85 million/ml after 5 months. The greatest increases were in micrococci + staphylococci (from 5000 to 56 000/ml) and enterococci (from 25 000 to 115 000/ml). Lactobacilli and coliforms increased ~3-fold and coryneforms and pseudomonads increased ~2-fold. The % *Pseudomonas* in the total flora was 4.7, 3.1, 5.7 and 4.2% on the 4 sampling occasions respectively. The increased counts were attributed to disruption of chains and clumps. CDA

1 T 68

Continuous fermentation to produce xanthan biopolymer: effect of dilution rate.

Silman, R. W.; Rogovin, P.

Abstracts of Papers. American Chemical Society 162: MICR 34 (1971) [En] [N. Marketing and Nutr. Res. Div., USDA, 1815 N. Univ. Street, Peoria, Illinois 61604, USA]

A previous report described the production of the biopolymer xanthan with *Xanthomonas campestris* NRRL B-1459 by single-stage continuous fermentation at dilution rates (D) to 0.0285 h<sup>-1</sup>. Observations indicated that xanthan production rate (XPR) was a function of D. Because an increased XPR would lower the cost of producing

the biopolymer, research was extended to investigate effect of D on XPR. Xanthan was produced by single-stage continuous fermentation in a medium of dextrose, minerals, distillers solubles and urea at D of 0.0233-0.196 h<sup>-1</sup>. Steady-state XPR increased from 0.34 g/h/kg at D = 0.0233 h<sup>-1</sup> to the max. 0.84 g/h/kg at about D = 0.15 h<sup>-1</sup>. At D > 0.15 h<sup>-1</sup> XPR decreased and at the highest D studied (0.196 h<sup>-1</sup>) was 0.69 g/h/kg. Yield of xanthan was 81-89% based on glucose consumed. Steady state ended between 6.5 and 8.7 turnovers of the fermentor contents when an organism variant occurred. AS

2 B 19

Chemistry of fruity flavours produced by *Pseudomonas fragi*.

Reddy, M. C. S.

Dissertation Abstracts International. Section B. The Sciences and Engineering 31 (2) 744-745: order no. 70-14139 (1970) [En] [St. Univ., Gorrallis, Oregon, USA]

Cultures of *Pseudomonas fragi* isolated from fruity flavoured Cottage cheese and pasteurized milk were grown at 21°C in sterile homogenized milk supplemented with 0.2% (v/v) ethanol. The ethyl esters of acetic, propionic, butyric, isovaleric and caproic acids were detected in the culture head space after a fruity aroma had developed; ethyl butyrate and ethyl caproate were the most abundant esters. Mixed cultures of *Streptococcus lactis* and *Ps. fragi* produced 5 as much ethyl butyrate and ethyl caproate as did single strain cultures of *Ps. fragi*. Esterases of *Ps. fragi* were intracellular and appeared to be most active on aromatic esters. Synergistic flavour threshold interactions (P < 0.01) were found for ethyl caproate/ethyl butyrate, ethyl butyrate/butyric acid, ethyl butyrate/ethyl acetate and ethyl caproate/ethyl isovalerate in milk. MJL

2 J 226

[Ripe black olives in brine. I. Physico-chemical and microbiological study of fermentation.]

Duran Quintana, M. C.; Garrido Fernandez, A. Gonzales Cancho, F.; Fernandez Diez, M. J. Grasas y Aceites 22 (3) 167-177 (1971) [17 ref.

Es, de, en, fr] [Inst. de la Grasa y sus Derivados, Dept. de Chim. y Microbiol., Seville, Spain]

4 varieties of ripe black olive (Hojiblanca, Lechin, Nevadillo Blanco and Nevadillo Negro) in brine were prepared in laboratory experimental fermentors and in industrial plants. After considering the main characteristics of the raw material (size, maturity), a microbiological and chemical study of the process was undertaken and characteristics of the product examined. At the beginning of fermentation, non-sporing gram negative bacteria of genera *Citrobacter*, *Klebsiella*, *Escherichia*, *Aeromonas* and *Achromobacter* were able to grow, but these were no longer present after 28 days. The chief organisms throughout the fermentation were yeasts. Lactobacilli were present only in variety Hojiblanca. No *Clostridium* spp. were observed, probably due to the rigid control of pH and NaCl concn. Concn. of reducing sugars and free acidity did not vary appreciably during fermentation. Organoleptic properties (smell, flavour, colour and texture) of both laboratory and industrial products were acceptable. RM





2 S 169

Characterization of a heat stable proteolytic enzyme from a psychrophilic strain of *Pseudomonas fluorescens* and its effect on the storageability of skim milk.

Maverhofer, H. J.

Dissertation Abstracts International, Section B, The Sciences and Engineering 31 (10) 6158: Order no. 71-8368 (1971) [En] [Univ., Columbia, Missouri, USA]

Optimum growth and protease production by the psychrophile *Pseudomonas fluorescens* P26 occurred at 21°C and pH 7.5 in a brain heart infusion broth medium. The crude protease was inactivated in the broth medium by heating at 71.4°C for 8.5 h but was not completely inactivated in the presence of skim-milk, whey or 2.5% casein. Dilutions of the purified enzyme produced a bitter off-flavour in milk stored at 4°C for up to 30 days. It was calculated that 450 000 *Ps. fluorescens* P26/ml raw milk could produce an off-flavour in milk stored at 4°C for 30 days, even though the organisms were themselves inactivated during pasteurisation. MJL

2 S 125

Microbiology of beef shell frozen with liquid nitrogen.

Rey, C. R.; Kraft, A. A.; Rust, R. E. *Journal of Food Science* 36 (6) 955-958 (1971) [19 ref. En] [Dept. of Food Tech., St. Univ., Ames, Iowa 50010, USA]

The effect of freezing primal cuts of beef with liquid N<sub>2</sub> on subsequent microbiological quality of their retail cuts was studied. Cryovac-packaged loins were shell frozen by spraying with liquid N<sub>2</sub> and held for 2 or 3 days at room temp. (25-27°C) in insulated styrofoam boxes. Frozen packaged loins were also aged at 2°C for 21 days and at 22°C for 3 days before being cut into steaks. Steaks from each treated loin and steaks from fresh loins (controls) were packaged and stored in a display case at ~5°C. Examination was made of the loins and packaged steaks during storage to determine total anaerobes, fluorescent *Pseudomonas*, coliforms, enterococci, *Clostridium perfringens*, and incidence of salmonellae and coagulase-positive staphylococci. Initial

contamination on steaks increased with loins aged for a long time at low temp. Ageing of loins at 22°C for 3 days promoted multiplication of *Cl. perfringens* and resulted in the steaks having the highest occurrence of coagulase positive *Staphylococcus*. Recovery of *Salmonella* from the steaks was more closely related to the source and level of contamination of the fresh meat than to time and temp. of holding of the wholesale cuts. These findings have application to shell freezing of beef with liquid N<sub>2</sub> for air transport and to possible commercial ageing practices. AS

2 S 137

Penetration of some microorganisms in meat.

Elmossalami, E.; Wassef, N.

*Zentralblatt für Veterinärmedizin, Reihe B* 18 (5) 329-336 (1971) [22 ref. En, de, fr, es] [Fac. of Vet. Med., Univ. Cairo, UAR]

The rates of penetration of some organisms into fresh, frozen and cooked meat were

investigated. *Salmonella enteritidis* penetrated into intact fresh meat to a depth of 15 cm within 36 h (30°C) and within 48 h if meat was stored at 7°C. It reached a depth of 10 cm after 60 h storage at -10°C. The rates of penetration of *Pseudomonas aeruginosa* into fresh meat held at 30°, 7° and -10°C were similar. The rates of penetration of the organisms investigated did not differ in cooked meat from those in fresh meat kept at 30°C in the case of *Salm. enteritidis* and *Proteus mirabilis*. *Streptococcus pyogenes* 'group A' penetrated least into intact fresh or cooked meat. *Salm. enteritidis*, *Pr. mirabilis* and *Ps. aeruginosa* remained at a depth of 1 cm after 12 h in frozen meat until the end of the experiment (60 h). *Str. pyogenes* and *Saccharomyces zimmeri* could not penetrate into intact frozen meat but remained viable on the surface. The public health hazard and economic importance of the results are discussed. AS

2 S 153

Action of *Pseudomonas fragi* on the proteins of pig muscle.

Tarrant, P. J. V.; Pearson, A. M.; Price, J. F.; Lechowich, R. V.

*Applied Microbiology* 22 (2) 224-228 (1971) [22 ref. En] [Dept. of Food Sci. and Human Nutr., St. Univ., East Lansing, Michigan 48823, USA]

Considerable salt-soluble protein degradation was observed in pork muscle inoculated with *Ps. fragi*. During a 20-day incubation period at 10°C, the samples proceeded to rank spoilage or putrefaction. There was a large decrease in the salt-soluble protein fraction and a corresponding increase in non-protein N. Disk gel electrophoretic patterns showed that breakdown of the salt-soluble proteins had occurred after incubation for 20 days. During incubation for 10 days at 10°C, *Ps. fragi* produced large amounts of extracellular proteolytic activity in ground pork. Most of the proteolytic activity appeared immediately after spoilage occurred. However, a significant increase in the ability to hydrolyse casein and a slight increase in the ability to hydrolyse denatured haemoglobin occurred prior to spoilage. AS

2 S 206

[The importance of udder inflammations in meat hygiene.] Die Bedeutung der Euterentzündungen im Rahmen der Fleischhygiene.

Szazados, I.

*Fleischwirtschaft* 51 (1) 49-52 (1971) [17 ref. De, en, fr] [Vadasz u. 17, Pecs, Hungary]

A report is given of extensive pathological/anatomical investigations on 105 animals with udder inflammations. It was found that only 41.9% of the animals could be declared fit for human consumption without any reservation, the other animals could only be accepted conditionally fit for consumption. A trend to Gram positive organisms, particularly *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* was

observed. It is stated that udder inflammations should receive more attention, and that a bacteriological examination should be carried out when udder inflammation is found. FWJ





## 3 B 24

Isolation of psychrophilic bacteriophage/host systems from refrigerated food products.

Whitman, P. A.; Marshall, R. T.

Applied Microbiology 22 (2) 220-223 (1971) [21 ref. En] [Dept. of Food Sci. and Nutrition, Univ., Columbia, Missouri 65201, USA]

38 bacteriophage/host systems were isolated from 22 of 45 refrigerated food products examined under psychrophilic conditions. Isolates were obtained from ground beef [11], pork sausage [4], chicken [4], raw skim-milk [2], and oysters [1], but not from liquid egg whites and processed meat products. 30 of the 38 psychrophilic bacterial hosts were Gram-negative rods, and 27 of these were classified within the genus *Pseudomonas*; 3 were members of the family Enterobacteriaceae. The remaining 8 were Gram-positive cocci, which were tentatively classified as *Leuconostoc*. Plate counts of psychrophilic bacteria were  $>2.2 \times 10^5$ /ml (or g) in all but 1 of the samples which contained phage, whereas phage titres ranged from  $<100$  to  $6.3 \times 10^6$  plaque-forming units/ml (or g). Phage isolates showed limited host ranges, usually attacking only those hosts from which they were isolated. Of 8 phages tested against 13 cultures of known identity, 1 showed lytic action, this being against strains of *Ps. fragi*. AS

## 3 B 30

[Some problems concerning bacteriological standards for food.]

Ormay, L.;

Elemezei Ipar 25 (3) 74-79 (1971) [47 ref. Hu, ru, de, en]

The incidence of food poisoning caused by bacteria has been steadily increasing in Hungary.

Between 1960 and 1969 a total of 1704 outbreaks of bacterial food poisoning was recorded. Of these 21.5% were caused by *Salmonella*, 1.2% by obligate pathogens (enteropathogenic *Escherichia coli*, *Shigella*, *Clostridium botulinum*), 60.0% by *Staphylococcus*, and 17.3% by conditional pathogens (*Bacillus cereus*, *Cl. perfringens*, *Streptococcus faecalis*, *Proteus*, *Klebsiella*, *Pseudomonas aeruginosa*, *E. coli*). Suggestions are made for improving conditions in food factories and shops and for standardizing bacteriological analysis. Problems relating to Hungarian standards for bacteriological quality of foods are discussed. IF

## 3 G 116

[Formation and degradation of nitrite in nitrate-containing infant foods. I. Through *B. subtilis*, *E. coli*, *Ps. fluorescens* and *Staph. albus*.] Entstehung und Abbau von Nitrit in nitrathaltiger Säuglingsnahrung I. Durch *Bac. subtilis*, *E. coli*, *Ps. fluorescens* und *Staph. albus* hervorgerufene Effekte.

Selenka, F.

Archiv für Hygiene und Bakteriologie 154 (4) 336-348 (1970) [59 ref. De, en, fr, es] [Hygiene-Inst., Univ., Mainz, W. Germany]

HUMANA I (ahumanized non-acidified infant formula) was reconstituted at 155 g/900 ml water and inoculated with 1-100 *Escherichia coli*, *Pseudomonas fluorescens* or *Staphylococcus albus* organisms or *Bacillus subtilis* spores/ml (levels

commonly present initially in milk formulae reconstituted in drinking water for infant feeding). After ~20 h at 25°C sufficient nitrate-reducing organisms ( $\sim 10^7$ /ml) were present to commence nitrate reduction and during the next 6-8 h nitrate in samples inoculated with *E. coli*, *Ps. fluorescens* or *B. subtilis* was approx. quantitatively reduced to nitrite, which was then further broken down by *E. coli* and *Ps. fluorescens*. Nitrite formation by *Staph. albus* was only detected after 38 h at 25°C and at a very low

level. With incubation at 15°C, only *Ps. fluorescens* produced measurable amounts of nitrite, which was first detected after 38 h. Nitrite formation may occur earlier in infant formulae reconstituted with drinking water under unhygienic conditions, and present a nitrite hazard in infant feeding. CDA

## 3 H 429

[Action of *Acetobacter aceti* on some constituents of wines.]

Spettoli, P.; Bolcato, V.

Industrie Agrarie 9 (7/8) 261-266 (1971) [38 ref. It, en] [Istituto di Ind. Agrarie, Univ., Padua, Italy]

Effects of *Acetobacter aceti* on 1 white and 7 red wines were studied. 2 different strains were used, and were cultured in the wines for 7-19 days at 30°C. Changes occurring in the chemical characteristics of the wines, tabulated in detail, included: decreases in pH and contents of alcohol (by ~90%), glycerol (by between 9 and 25%), tannins (9-20%), higher alcohols (7-30%), succinic + lactic acids (27-76%), malic acid (48-74%), tartaric acid (10-15%) and 2,3-butylene glycol (33-43%); increases in contents of volatile acids, total acids, esters (by between 704 and 1550%), acetaldehyde (266-1200%) and acetoin (564-3606%); reduction in diacetyl contents (78-89%). Of 2 of 4 samples tested, with increase (~1060%) in the other 2 samples. The colour of the wines was not affected, but the quality rating was low. HBr

## 3 J 412

Microbial flora of pecan meat.

Chiple, J. R.; Heaton, E. K.

Applied Microbiology 22 (2) 252-253 (1971) [11 ref. En] [Dept. of Food Sci., Univ. Coll. of Agric., Expt. Sta., Experiment, Georgia 30212, USA]

All bacterial and fungal flora on (i) commercially shelled and (ii) aseptically shelled pecan meats, were isolated and identified. (i) and (ii) were stored at 4°C until microbiologically examined. Sterilization of (ii) was with 1.0 mM  $HgCl_2$ . A medium of aseptic trypticase soy agar was used for isolation of the bacteria, and a 2% (w/v) agar (Difco) medium was used for isolation of fungi. (i) and (ii) were also examined for penetration of fungal hyphae by examining thin (25 nm) sections of pecan meat previously impregnated with liquefied paraffin wax for 48 h. (i) Contained *Pseudomonas* spp., *Corynebacterium* spp.,





paurometabolum, *Escherichia coli*, *Leuconostoc mesenteroides*, *Proteus vulgaris*, *Aerobacter aerogenes* and *Clostridium* spp. No bacteria were found in (ii). *Penicillium notatum*, *Aspergillus clavatus*, *A. niger*, *Fusidium* spp. and *Tricothecium* spp. were found in (i). In (ii) *Aspergillus clavatus* and *Tricothecium* were identified. No penetration of fungal hyphae was observed, although this can occur in commercially shelled pecan meat. PA

### 3 J 431

[Some characteristics and contents of American cranberries (*V. macrocarpon* Ait.), European cranberries (*V. oxycoccus* L.) and cowberries (*V. vitis-idaea* L.).] Über einige Gütemerkmale und Inhaltsstoffe der Kulturpreiselbeeren (*V. macrocarpon* Ait.), Moosbeeren (*V. oxycoccus* L.) und Preiselbeeren (*V. vitis-idaea* L.). Matzner, F.

Industrielle Obst- und Gemüseverwertung 56 (2) 27-32 (1971) [14 ref. De] [Inst. für Obstbau, Tech. Univ., Munich, Weihenstephan, W. Germany]

(i) American cranberries, (ii) European cranberries, and (iii) cowberries were analysed in the years 1966, 1967 and 1970. The following data were found: wt. of 100 fruits of (i), 63.65-206.36 g; sp. wt. average 0.6775 g/cm<sup>3</sup> (range 0.6268-0.7150 g/cm<sup>3</sup>). DM content was: (i), 12.24-14.60%; (ii), 11.33-12.64%; (iii) 14.40-15.96%. Insoluble DM content of (i) varied with fruit size, being higher in small fruits (4 and 2%). Acid content, calculated as citric acid, was for fresh material and DM respectively; (i) 2.14-2.42%, 15.43-18.71%; (ii), 2.85, 22.69%; (iii) 1.83, 11.70%. Vitamin C content of fresh and DM respectively was: (i) average 31.5 mg% (range 23.8-38.2), 246 mg% (range 172-300); (ii) 31-49 mg%, 246-300 mg%; (iii) 10.1-29.0 mg%, 70-182 mg%. Average values are not given for (ii) and (iii) because of low number of samples. Dehydro ascorbic acid content of (i) was 6.8-38.0% depending on variety and showed no relation to vitamin C content. Expressed fruit juice of (i) a dilution of 1:30-40 showed some inhibition of growth of

*Pseudomonas aeruginosa*, *Micrococcus pyogenes* var. *aureus*, *Escherichia coli* and *Bacillus subtilis*, in a dilution of 1:30-40. JMS

### 3 N 133

[Microorganisms in margarine affected by spoilage. II. Isolation and identification of species: bacteria.]

Castanon, M.; Inigo, B.

Microbiologia Espanola 24 (1) 49-65 (1971) [21 ref. Es, en]

Bacteria isolated from samples of spoilage-affected margarine [see preceding abstr.] were studied. Gram- and catalase-positive strains (4 strains) were identified as *Staphylococcus aureus* and *Staph. epidermidis*; lactic acid bacteria (2 strains) as *Lactobacillus plantarum*; Gram-negative bacteria (7 strains) as *Zymomonas mobilis*. HBr

### 3 R 124

Experimental studies on the growth of *Pseudomonas fragi* in precooked fish and its influence on the decomposition of the fish during storage at +4°C. Florin, S. O.

Nordisk Veterinärmedicin 23 (10) 484-498 (1971) [34 ref. En, sv] [Dept. of Food Hygiene, Nat. Inst. of Public Health, Stockholm, Sweden]

Twelve 150 g samples of pike-perch were lightly salted, vacuum packaged in Nylon 11 bags, simmered in water for 20 min at 90°C and cooled. 11 samples were then packaged in a sterile outer plastics pouch and stored overnight at 4°C; the other sample, for use as a taste reference, was frozen and stored at -20°C for 22 days. 6 samples were inoculated with 0.5 ml of air, followed by 0.05 ml of a *Pseudomonas fragi* strain F 111 suspension, containing  $1.5 \times 10^6$  organisms; the remaining 5 non-inoculated packs were used as control samples. Each pack was enclosed in an air-filled pouch and stored at 4°C for up to 21 days. At intervals during storage, a pack was opened, and surface colony count, total *Ps. fragi* count, volatile basic N content and taste of fish samples were determined at 3 sites, one being the point of inoculation. Tables and graphs of results are given. Growth of *Ps. fragi* was confined to the area of inoculation, probably because of the restricted O<sub>2</sub> supply and low water activity. Volatile basic N contents showed no change attributable to *Ps. fragi*. Taste of non-irradiated samples did not change during storage; inoculated samples showed deterioration of taste after storage for 10 days. AJDW

### 3 S 279

Bacteriological condition of dressed chicken during the process of retailing.

Panda, P. C.

Indian Veterinary Journal 48 (9) 927-931 (1971) [10 ref. En] [Central Food Tech. Res. Inst., Mysore, India]

The total aerobic count, coli-aerogenes count, faecal streptococci count and mould count on the skin surface of dressed chicken offered for sale in Mysore and Bangalore were found to be within the ranges of  $2.5 \times 10^5$  to  $5.4 \times 10^6$ , 73 to 116,  $1.2 \times 10^3$  to  $3.2 \times 10^4$  and  $1.3 \times 10^3$  to  $4.5 \times 10^4$ /cm<sup>2</sup> respectively. Microorganisms isolated from the skin surface of dressed birds available for sale in different parts of the country belonged to the genera *Micrococcus*, *Staphylococcus*, *Streptococcus*, *Pseudomonas*, *Achromobacter*, *Lactobacillus*, *Flavobacteria*, *Aeromonas*, *Bacillus*, *Salmonella* and *Escherichia*. The importance of the microbial load and different types of organisms in relation to hygiene and public health is discussed. AS

### 3 S 280

Extracellular enzymic activity of poultry spoilage bacteria.

Barnes, E. M.; Melton, W.

Journal of Applied Bacteriology 34 (3) 599-609 (1971) [38 ref. En] [Food Res. Inst., Colney Lane, Norwich NOR 70F, UK]

The extracellular enzymic activity has been studied of 224 strains of bacteria isolated





mainly at 1°C from spoiling chickens and turkeys and from poultry processing plants. The isolates comprised 44 strains of pigmented *Pseudomonas*, 57 strains of non-pigmented *Pseudomonas*, 29 strains of *Ps. putrefaciens*, 50 strains of oxidase-positive *Acinetobacter* and 44 strains of oxidase-negative *Acinetobacter*. None of the strains showed any significant activity against dextrin, starch, glycogen, inulin, dextran, xylan or pectin. Proteolytic activity was found mainly amongst 2 groups of pigmented pseudomonads, and *Ps. putrefaciens*. Nuclease activity was found particularly amongst strains of *Ps. putrefaciens* and the oxidase-negative *Acinetobacter* strains isolated from spoiling poultry. Almost all of the strains showed lipolytic activity when tested with tributyrin and a proportion of strains could also attack chicken fat. This latter property was particularly evident amongst the nonpigmented *Pseudomonas* strains. AS

### 3 S 363

Poultry product quality. V. Microbiological evaluation of mechanically deboned poultry meat. Ostovar, K.; MacNeil, J. H.; O'Donnell, K. *Journal of Food Science* 36 (7) 1005-1007 (1971) [13 ref. En] [Div. of Food Sci. & Ind., St. Univ., University Park, Pennsylvania 16802, USA]

Samples of deboned meat from broiler necks and backs, whole fowl and turkey racks were obtained from commercial sources and examined for total aerobic counts, faecal coliforms, salmonellae, *Clostridium perfringens*, coagulase positive staphylococci and psychotolerant microorganisms. Raw materials were either deboned immediately after birds were processed (conventional processing) or held in the plants at 3-5°C for 5 days prior to deboning (delayed processing). Storage studies were conducted by holding deboned meat at 3°C for 0, 3, 6 and 12 days and at -15°C for periods of 3, 6 and 19 months. Total aerobic counts of delayed processed samples were shown to be higher than conventionally processed meat and remained the same throughout the storage period. In all instances, total aerobic counts increased during storage at 3°C. The MPN faecal coliforms were high for all samples and remained relatively the same throughout the storage period at 3°C. Freezing resulted in a significant reduction of faecal coliforms. Only 6 out of 54 samples were contaminated with salmonellae while 4 showed the presence of *Cl. perfringens* and none was contaminated with *Staph. aureus*. *Pseudomonas*, *Achromobacter* and *Flavobacterium* dominated the psychrotolerant genera isolated in this investigation. AS

### 4 B 33

The effect of sorbic acid on the growth of triamineoxidase and urease containing bacteria isolated from fresh fish.

Debevere, J. M.; Voets, J. P.; Pudjo Tjiptono, A. *Mededelingen van de Faculteit Landbouwwetenschappen Rijksuniversiteit Gent* 36 (2) 555-560 (1971) [13 ref. En, fr, sl]

The inhibitory effect of sorbic acid on the growth of bacteria isolated from dogfish (*Squalus acanthias* L.) was studied. Urease positive strains

of *Pseudomonas* sp. and *Micrococcus* sp. and a triamineoxidase containing *Achromobacter* sp. strain were used for the experiments. A graph is given of the influence of sorbic acid on the bacterial growth in relation to the pH of the growth medium. Bacteriostatic activity of sorbic acid increases as pH decreases; thus addition of 0.3% sorbic acid to a culture of *Achromobacter* sp. over the range pH 7.1-5.7 resulted in a linear inhibition of the growth curve; with *Pseudomonas* sp. no increase of growth was observed between pH 5.7 and 6.5 on addition of 0.3% sorbic acid; and on addition of 0.3% sorbic acid to a culture of *Micrococcus* sp. growth was completely inhibited between pH 5.7 and 6.5 and reduced growth occurred between pH 6.5 and 7.1. AB

### 4 R 191

[Influence of herring microorganisms on fat oxidation. I. Decomposition of linoleic acid hydroperoxides.] Einfluss von auf Heringen wachsenden Mikroorganismen auf die Fettoxydation. I. Abbau von Linolsäurehydroperoxyden. Grosch, W.; Senser, F.; Fischer, K.

*Zeitschrift für Lebensmitteluntersuchung und -Forschung* 147 (3) 140-144 (1971) [17 ref. De, en] [Deutsche Forschungsanstalt für Lebensmittelchemie, Munich, W. Germany]

Of 11 microorganisms (MO) isolated from herrings, 2 caused rapid breakdown of linoleic acid hydroperoxides, while 9 caused slower breakdown. The effect on 13- and 9-hydroperoxyoctadecadienoic acids of the culture media of 1 MO from the first group and 2 from the second was studied. The MO causing rapid breakdown (a yeast) and one of the second group (a strain of *Pseudomonas fluorescens*) caused reduction of the hydroperoxy acids to the corresponding hydroxy acids. The other MO of the second group did not have this effect. DSW

### 4 R 204

[Bacteria isolated from the Adriatic sea and alteration of the fish.]

Cabassi, E.; Allodi, C.; Perna, A.

*Igiene Moderna* 63 (3) 140-152 (1971) [20 ref. It, en] [Istituto di Microbiol., Fac. di Med. Vet., Univ., Parma, Italy]

In a study of the effect of bacteria on fish, 'spoilage' and 'non-spoilage' strains were examined. 503 strains were isolated from Adriatic sea-water and propagated at 0-5°C in Anderson sea-water and at 5°C in a medium comprising a whiting muscle extract in distilled H<sub>2</sub>O and 8% NaCl, centrifuged and sterilized and with a pH of 6.5. The extract was used to check which strains produced bad odours due to bacterial attack on the tissues. 121 strains developed over 14 days at 0°C in Anderson broth, 245 over 10 days at 5°C in the broth and 245 developed over 10 days at 5°C in the fish medium. 30 strains which were





considered to be spoilers, i.e. they produced bad odours, included *Aeromonas*, *Bacillus*, *Corynebacterium*, *Achromobacter*, *Plasmococcus*, *Pseudomonas*, *Vibrio* and atypical enterobacteria (5.97% of the total). 215 strains which developed at 0°C did not produce bad odours but were considered to have a complementary activity in that they produced e.g.  $H_2S$  from cystine,  $NH_3$  from peptones, in the fish medium. LA

#### 4 R 207

**Biochemical changes in shrimp inoculated with *Pseudomonas*, *Bacillus* and a coryneform bacterium.**

Cobb, B. F., III; Vanderzant, C.

*Journal of Milk and Food Technology* 34 (11) 533-540 (1971) [28 ref. En] [Animal Sci. Dept., & Univ., College Station, Texas 77843, USA]

White shrimp (*Penaeus setiferus*) washed with ethanol and sterile water were inoculated with a fluorescent *Pseudomonas*, non-fluorescent *Pseudomonas*, *Bacillus*, and coryneform bacterium. Washing reduced microbial load but growth occurred on control samples during refrigerated storage. Samples inoculated with *Pseudomonas* became putrid 2-3 days sooner than controls. Addition of coryneform bacteria delayed spoilage. Shrimp inoculated with *Bacillus* spoiled at the same time as non-inoculated controls. Inoculation of shrimp with *Pseudomonas* species: (a) retarded development of melanosis; (b) produced volatile  $N_2$  in the atmosphere surrounding shrimp but only after spoilage had taken place; (c) caused higher levels of water-soluble protein, non-protein N, and total volatile N than in their corresponding controls; and (d) reached higher pH levels sooner than controls. No significant changes occurred in volatile reducing substances. Sterile shrimp juices exhibited more extensive melanosis than juices inoculated with *Pseudomonas*. No marked changes in amounts of soluble protein or non-protein N were noted upon storage of inoculated juices. Juices inoculated with *Pseudomonas* had higher levels of total volatile N after storage than comparable controls. Proteolysis by fluorescent *Pseudomonas* was indicated by major changes in elution profiles on Sephadex G-100. Compared with sterile controls, levels of free amino acids decreased in juices inoculated with *Pseudomonas* or *Bacillus* and stored at 5°C. AS

#### 4 S 414

**[The importance of psychrotrophic bacteria in meat hygiene with particular reference to *Pseudomonas*.]** Die fleischhygienische Bedeutung kältetoleranter Keime, unter besonderer Berücksichtigung der *Pseudomonaden*.

Lott, G.

*Wiener Tierärztliche Monatsschrift* 58 (11) 402-408 (1971) [43 ref. De, en] [Vet.-Bakt. Inst., Univ., Winterthurer Strasse 270, CH-8057 Zurich, Switzerland]

A positive correlation exists between the number of pseudomonads and psychrotrophic spoilage organisms in meat and meat products. Enumeration of pseudomonads on glutamate-starch-phenol-red agar is advocated as the method of choice, instead of time consuming identification methods necessary for other psychrotrophic organisms. Histograms and graphs of total psychrotrophic bacteria and pseudomonad counts in packed fresh meat, chopped meat, and sliced meat with liver are given (ranges of <100 000->10 million/g, <500 000->100 million/g, and <50 000->5 million/g, respectively). A high level of contamination during handling and processing was evident. Resultant organoleptic changes caused by subsequent proteolysis and lipolysis are briefly mentioned. OA

#### 4 S 516

**Influence of bacteria on the carbonyl compounds of ground porcine muscle.**

Bothast, R. J.

*Dissertation Abstracts International. Section B. The Sciences and Engineering* 32 (5) 2502: Order no. 71-28922 (1971) [En] [Polytechnic Inst., Blacksburg, Virginia, USA]

A study was made of the effect of *Micrococcus cryophilus* (i), *Pseudomonas fluorescens* (ii), *Pseudomonas cerevisiae* (iii) and *Staphylococcus aureus* (iv) on the carbonyl compounds of ground porcine muscle. Carbonyl compounds in fresh, dip, inoculated and non-inoculated muscle samples were converted to 2,4-dinitrophenylhydrazones and separated into monocarbonyl classes. Total carbonyls were decreased by (i), (ii) and (iv) by 57.4, 18.1 and 43.0% respectively and total monocarbonyls by 53.3, 20.4 and 33.3% respectively. (iii) increased the total carbonyl and total monocarbonyl content by 70.3 and 71.3%. The concn. of carbonyls observed in the control samples indicated a direct relationship between incubation temp. and carbonyl concn. The quantitative effects established on total carbonyls and monocarbonyls were consistent for the monocarbonyl classes. (i), (ii) and (iv) decreased methyl ketones, saturated aldehydes, 2-enals and 2,4-dienals; while (iii) increased each of the classes. TLC and GLC and MS analyses showed that the microorganisms examined in this study did not qualitatively influence individual monocarbonyl compounds. AB

#### 4 T 235

**Effect of minerals upon production of glutamic acid by *Pseudomonas aeruginosa*.**

Goswami, S. K.; Majumdar, S. K.

*Journal of Food Science and Technology (Mysore)* 8 (3) 148-149 (1971) [2 ref. En] [Dept. of Food Tech. and Biochem. Eng., Jadavpur Univ., Calcutta-32, India]

*Ps. aeruginosa*, grown in a medium consisting of 5% sodium citrate, 1%  $NH_4Cl$ , 0.1%  $K_2HPO_4$  and 0.05%  $MgSO_4 \cdot 7H_2O$ , produced higher amounts of glutamic acid when Fe and Zn were present in the medium at levels of 10 and 0.05 µg/ml





respectively. The addition of Mn and Cu had no effect on glutamic acid production. Optimum conditions for growth of *Ps. aeruginosa* were different from those for glutamic acid production. MEG

5 B 56

**Biochemical and industrial aspects of fermentation.** [A book]

Sakaguchi, K.; Uemura, T.; Kinoshita, S. (Editors) 356pp. (1971) [Numerous ref. En] Tokyo Japan: Kodansha Ltd. Price US \$19.50 Japan 6000 Yen

This book, comprised of articles by leading Japanese workers, gives an overall picture of current applied microbiology in Japan. The articles include: Metabolic control in the modern fermentation industry, by S. Kinoshita (pp. 9-35, 49 ref.); Industrial production of nucleotides, nucleosides and related substances, by K. Ogata (pp. 37-59, 43 ref.); Petroleum microbiology and vitamin production, by K. Yamada, T. Nakahara and S. Fukui (pp. 61-90, 82 ref.); Industrial production of enzymes, by J. Fukumoto and S. Shichiji (pp. 91-117, 22 ref.); Antibiotics and other related microbial products, by H. Umezawa (pp. 119-153, 40 ref.); Gibberellins and other biologically active substances produced by microorganisms, by S. Tamura (pp. 155-173, 88 ref.); Alkaloid and steroid production by microorganisms, by M. Abe and H. Iizuka (pp. 175-200, 46 ref.); The classification and biochemistry of acetic acid bacteria, by T. Asai (pp. 201-232, 87 ref.); Phage contamination and control in the fermentation industry, by M. Hongo (pp. 233-265, 56 ref.); Automatic process control of continuous fermentation, by S. Shichiji (pp. 267-296, 34 ref.); Purification of industrial wastes by microbial methods, by H. Ono, Y. Kaneko, M. Ito and K. Tonomura (pp. 297-328, 23 ref.); Bacterial leaching in the mining industry, by K. Imai (pp. 329-336, 14 ref.); and Fermentation in the rumen, by T. Suto and T. Uemura (pp. 337-356, 23 ref.). JN

5 B 59

**Substituted diazenes: effect on the growth of enterobacteria and possible use as selective agents for isolation of pseudomonads.**

Rose, M. J.; Enkiri, N. K.; Sulzbacher, W. L. *Applied Microbiology* 22 (6) 1141-1146 (1971) [8 ref. En] [Meat Lab., USDA, Wyndmoor, Pennsylvania 19118, USA]

Incorporation of various diazenes into trypticase soy media appeared selectively to permit the growth of pseudomonads while inhibiting the growth of a variety of enterobacteria. One of these diazenes, diamide (diazenedicarboxylic acid bisdimethylamide), was shown to be bactericidal for pure cultures of *Escherichia coli*, *Proteus* sp. and *Almonella enteritidis* and to cause a 1- to 2-h delay in the growth of *Pseudomonas aeruginosa*. When mixtures of these 4 organisms were inoculated into trypticase soy broth or trypticase soy agar (TSA)

containing diamide, *Ps. aeruginosa* grew in overnight cultures. TSA containing diamide was also used successfully to isolate pseudomonads from soil, clinical urine specimens, fish, ground beef, ground pork, and ground veal. AS

5 G 261

**[Formation and degradation of nitrite in nitrate-containing infant foods. II. The effects of natural and artificial mixtures of organisms.] Entstehung und Abbau von Nitrit in nitrathaltiger Säuglingsnahrung. II. Wirkung von natürlichen und künstlichen Keimgemischen.**

Selenka, F.

*Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, I. Abteilung, Originale, Serie B* 155 (1) 58-69 (1971) [30 ref. De, en] [Hygiene-Inst., Univ., Mainz, W. Germany]

Although the nitrite formed from nitrate in infant foods by *Pseudomonas aeruginosa*, *Escherichia coli* and *Bacillus subtilis* is generally further broken down [see part I, *FSTA* (1972) 4 3G116] *Ps. aeruginosa* and *B. subtilis* were unable to bring their nitrite degrading properties into action in the presence of other organisms. 2 different nitrite degradation patterns were observed: when faecal coliforms were incubated alone or with other organisms, including *B. subtilis*, the nitrite formed disappeared within 5-6 h; but when *B. subtilis* was incubated with either *Ps. aeruginosa* or *Streptococcus faecalis*, nitrite accumulated and persisted in the medium sometimes for several days. This latter type of degradation is regarded as more deleterious than that of *E. coli*, and shows that boiling of food is not an adequate measure for preventing exogenous nitrite intoxication. CDA

5 H 751

**The microbiology of brewing.** [A review]

Kleyn, J.; Hough, J.

*Annual Review of Microbiology* 25: 583-608 (1971) [252 ref. En] [Dept. of Biol., Univ., Puget Sound, Tacoma, Washington, USA]

This comprehensive review covers the subject under the headings: historical, organization of the brewing industry, literature of brewing, teaching and research in the industry, bacteria encountered in breweries (lactic acid, coliform, acetic acid, *Obesumbacterium proteus*, *Zymomonas anaerobia*), wild yeasts, outline of traditional brewing processes, outline of advanced brewing processes, microbiology of brewing materials, selection and propagation of brewers' yeast, yeast management, growth and metabolism, growth and fermentation kinetics, yeast cell wall, brewing yeast genetics, microbiological control in brewing, fermentation, and packaging including sanitation, aseptic packaging. HBr





S H 781

**Microflora of fermenting palm sap.**

Faparusi, S. I.; Bassir, O.

*Journal of Food Science and Technology (Mysore)* 8 (4) 206 (1971) [1 ref. En] [Dept. of Biochem., Univ., Ibadan, Nigeria]

Unpasteurized palm sap was left for 7 days at room temp. (25°C) and at 12 h intervals the number of viable microorganisms estimated by dilution plate count on appropriate media. A graph illustrates the succession of different microorganisms. *Lactobacillus* and *Leuconostoc* spp. were active during the early stages; also yeast I group, consisting of *Saccharomyces cerevisiae* predominated. From the 3rd day another set of yeasts, designated as yeast II, consisting of *Schizosaccharomyces pombe*, *Pichia* spp. and *Candida mycoderma* started appearing. *Acetobacter* spp. began to appear after 48 h and steadily increased; also species of *Aspergillus*, were extracted quantitatively in the range of 0.15-3.75, 0.25-6.25, 0.40-10.00 and 0.20-5.00 mg/100 ml respectively. The alcohol content of both the test and standard solutions must be brought to the same level before CS<sub>2</sub> extraction. Reduced quantity of CS<sub>2</sub> should be used for extracting small amounts of esters. Comparative determinations on 6 brandies and 3 wine distillates showed the following % loss for CS<sub>2</sub> and ether extraction respectively: capronate 26-86 and 51-93%; caprylate 93-109 and 86-98%; caprinate 88-114 and 87-106%; laurate 70-110 and 93-94%. Large discrepancies in the amounts of capronate were due to an interfering compound in the ether extract. Recovery tests of CS<sub>2</sub> extracts with model brandy and wine distillate gave 100-107 and 98-104% capronate, 95-100 and 99-102% caprylate, 98-100 and 98-102% caprinate, and 99-102 and 99-104% laurate. Owing to formation of emulsions, wines could not be examined directly but by means of distillates produced after fortification to 20-25 vol. % alcohol. It is concluded that the CS<sub>2</sub> extraction method shows all-round superiority over gas chromatography. RM

S P 680

**Numerical taxonomy of the genus *Pseudomonas* from milk and milk products.**

Samagh, B. S.; Cunningham, J. D.

*Journal of Dairy Science* 55 (1) 19-24 (1972) [30 ref. En] [Dept. of Microbiol., Univ., Guelph, Ontario, Canada]

653 organisms capable of growth at 5°C, but incapable of splitting lactose or utilizing proteins in preference to lactose, were isolated from 136 samples of milk and milk products. 182 of the isolates, which were identified as *Pseudomonas* spp., and 16 known *Pseudomonas* spp. were classified into 4 groups on 97 characters according to Adansonian analysis using an IBM 1620-60 K digital computer to compute % positive similarities (S values). *Ps. fluorescens* (8 known strains), *Ps. aeruginosa* and 98 of the isolates were classified into group I, with an S value of 85%; group II had

an S value of 81% and included *Ps. putida* and 80 isolates. Groups III and IV respectively, which included 15 isolates + 4 known spp. and 5 isolates + 2 known spp., had S values of only 56 and 60%; however, when negative matches were included (M values) the similarities were 78 and 85%. Whether negative matches should count as a similarity in numerical taxonomy of bacteria has yet to be decided. CDA

S P 790

**[Pseudomonads and aeromonads in market milk: detection and estimation.] Pseudomonaden und Aeromonaden in Trinkmilch: Ihr Nachweis und ihre Bewertung.**

Kielwein, G.

*Archiv für Lebensmittelhygiene* 22 (1) 15-19

(1971) [27 ref. De] [St. Tierärztliches

Untersuchungsamt, Aulendorf, German Federal Republic]

277 samples of pasteurized market milk were examined for the presence of *Pseudomonas* & *Aeromonas* spp., the 2 genera being differentiated by the author's method [see FSTA (1971) 3 11B338]. In addition, samples of pasteurized milk were infected artificially with cultures of selected strains of *Pseudomonas* and *Aeromonas* (1000-5000/ml milk), stored for up to 7 days at 8°C and examined at intervals for changes in counts and organoleptic properties. ~50% of the pasteurized market milk samples contained *Pseudomonas* spp. and ~10% *Aeromonas* spp. The 200 strains of *Pseudomonas* isolated included 113 strains of *Ps. fluorescens*, 27 of *Ps. putida*, 8 each of *Ps. taetrolens* and *Ps. fragi*, 16 of *Pseudomonas* spp. and 28 of *Ps. putrefaciens*. Of 27 strains of *Aeromonas* isolated, 6 were identified as *Aer. hydrophila* and 21 as *Aer. hydrophila* var. *anaerogenes*. Counts of *Pseudomonas* and *Aeromonas* spp. in the artificially infected samples rose rapidly to several millions after 3 days at 8°C, reaching up to 720 million/ml (*Ps. fragi*). After 3 days' storage, only some of the samples exhibited adverse flavour changes whereas, after 4 days, the majority of samples exhibited pronounced flavour defects. EJM

S Q 63

**Microbial counts and organic acid quantitation as quality indices of egg products.**

York, L. R.

*Dissertation Abstracts International. Section B.**The Sciences and Engineering* 32 (6) 3427: Order no. 71-31338 (1971) [En] [St. Univ., East Lansing, Michigan 48823, USA]

Commercial liquid, frozen and dried eggs were sampled by the Michigan Department of Agriculture as a part of their food inspection programme. The direct microscopic counts of the whole egg products ranged from <20 000 to 4 600 000 organisms/g. Lactic acid (2-5 mg/100 g egg) was the only acid detected. No correlation existed between the microbial counts and the lactic acid content of the egg. Samples of aseptically prepared





liquid whole egg were inoculated with a single species of bacteria (*Pseudomonas fluorescens*, *Achromobacter xerosis*, *Escherichia coli*, *Salmonella choleraesuis*, *Streptococcus faecalis* or *Staphylococcus aureus*) and incubated for up to 22 h. The control samples of liquid whole egg contained both acetic acid (0.3-2.5 mg/100 g egg) and lactic acid (1.4-7.6 mg/100 g egg), as did all of the inoculated samples. Succinic acid (0.2-0.6 mg/100 g egg) was present in egg in which *Str. faecalis*, *Salm. choleraesuis* and *E. coli* had grown. Formic acid was found only in egg which had been decomposed by *E. coli* and only in small amounts. High quality, pasteurized liquid whole egg was found to remain wholesome for 5 and 13 days when stored at 9 and 2°C respectively. The pasteurized egg contained no *E. coli*, salmonellae, streptococci or staphylococci. AB

5 R 250

**Trimethylamine-producing bacteria on haddock (*Melanogrammus aeglefinus*) fillets during refrigerated storage.**

Laycock, R. A.; Regier, L. W.

*Journal of the Fisheries Research Board of Canada* 28 (3) 305-309 (1971) [12 ref. En] [Fisheries Res. Board, Halifax Lab., Halifax, Nova Scotia, Canada]

All of psychrophilic groups of organisms isolated from haddock (*Melanogrammus aeglefinus*) fillets during storage at 3°C included organisms capable of producing trimethylamine (TMA) from trimethylamine oxide (TMAO). The % of TMA-producing isolates in the flora remained nearly constant during storage to spoilage, although the composition altered markedly. All *Pseudomonas putrefaciens* isolates were TMA producers and this organism was the most numerous TMA producer during storage. It was concluded that in this investigation *Ps. putrefaciens* was largely, if not wholly, responsible for observed TMA production. *Achromobacter* spp., although initially forming over half the TMA-producing flora, formed a decreasing % during storage and were not considered to contribute significantly to observed TMA production. *Coryneforms* were the only group to show an increase in % of TMA producers during storage. AS

5 R 255

**The bacteriology of 'scampi' (*Nephrops norvegicus*). III. Effects of processing.**

Hobbs, G.; Cann, D. C.; Wilson, B. B.; Horsley R. W.

*Journal of Food Technology* 6 (3) 233-251 (1971) [16 ref. En] [Torry Res. Sta., Aberdeen, UK]

Bacteriological data were obtained from 5 factories producing frozen scampi and frozen breaded scampi. There was no significant increase or decrease in bacterial numbers during processing, and where increases did occur they were attributable to contamination during hand peeling. Initial levels of contamination were seen to vary between the factories. This can be explained to a large extent by the distance of the individual

factory from the port of landing. Studies of the spoilage flora during storage on ice showed that bacteria of the group *Pseudomonas-Achromobacter* predominate. [See FSTA (1971) 3 12R519 for part II.] BFMIRA

5 R 264

**[Influence of herring microorganisms on fat oxidation. II. Respiration of linoleic acid hydroperoxides.] Einfluss von auf Heringen wachsenden Mikroorganismen auf die Fettoxydation. II. Veratmung von Linolsäurehydroperoxyden.**

Senser, F.; Grosch, W.

*Zeitschrift für Lebensmitteluntersuchung und -Forschung* 147 (4) 200-206 (1971) [1 ref. De, en] [Deutsche Forschungsanstalt für Lebensmittelchemie, Munich, W. Germany]

75 potential psychrophilic and lipolytic microorganisms were isolated from 'green' herrings and examined for growth on linoleic acid and sunflower oil, and metabolism of hydroperoxides. The strains were divided into 3 groups according to their breakdown of hydroperoxides and 3 type strains, 29, 70 and 75, examined in detail. Strain 29 utilized hydroperoxides very rapidly, 75 to a smaller extent, and 70 were inhibited by hydroperoxides. 3 fungi were unable to utilize hydroperoxides. No similarity in hydroperoxide utilization was found between related strains of *Pseudomonas*. [See FSTA (1972) 4 4R191 for part I.] RM

5 S 551

**Observations by electron microscopy on pig muscle inoculated and incubated with *Pseudomonas fragi*.**

Dutson, T. R.; Pearson, A. M.; Price, J. F.; Spink, G. C.; Tarrant, P. J. V.

*Applied Microbiology* 22 (6) 1152-1158 (1971) [15 ref. En] [Dept. of Food Sci. & Human Nutr., St. Univ., East Lansing, Michigan 48823, USA]

Miofibrils from pig muscle inoculated and incubated with *Pseudomonas fragi* showed an extremely disrupted appearance as compared to uninoculated controls. There was an almost complete absence of material in the H zone, marked disruption of the A band (probably myosin), and some loss of dense material from the Z line. These changes indicated that marked proteolysis had occurred. Bacteria observed in spoiled muscle tissue exhibited protrusions or blebs on the outer surface of the cell walls. The blebs appeared to form detached globules that migrated into the muscle mass. Bacteria grown in the non-muscle-containing media did not produce blebs, which indicates the blebs were induced by growth on muscle tissue. The possibility that the blebs and globules may contain a proteolytic enzyme responsible for myofibrillar disruption is discussed. AS





5 S 581

**Ultrastructural changes in postmortem porcine muscle.**

Dutson, T. R.

*Dissertation Abstracts International. Section B.**The Sciences and Engineering* 32 (6) 3090-3091:

Order no. 71-31190 (1971) [En] [St. Univ., East Lansing, Michigan 48823, USA]

Muscle samples were taken from 10 normal pigs and 10 pigs with pale, soft and exudative musculature (PSE) at 15 min and 24 h post mortem for electron microscopic examination. Aseptic samples were also taken from one pig, and ground, inoculated and incubated and incubated with *Ps. fragi* showed marked disruption of with *Pseudomonas fragi*, and examined with the electron microscope. At 24 h post mortem the ultrastructure of normal porcine muscle was markedly altered as compared to that at 15 min post mortem. However, the differences between fibre types were still easily discernible; there was less post mortem disruption in red fibres than in intermediate or white fibres. All 3 fibre types from PSE muscle at 15 min post mortem showed more disruption than normal muscle, but appeared similar to normal muscle at 24 h post mortem. Pig muscle tissue inoculated myofibrils as compared to uninoculated incubated controls. After incubation the inoculated samples showed almost complete absence of material in the H zone, marked disruption of the A band and some loss of dense material from the Z line. These changes suggest that proteolysis had occurred.

AB

6 J 915

**[The effect of sorbic acid and heating on *Pseudomonas fluorescens*.]**

Sevostyanova, N. A.; Bogdanova, N. V.; Khetsuriani, K. G.

*Konservnaya i Ovoshchesushil'naya**Promyshlennost'* 1971 (4) 30-31 (1971) [3 ref. Ru] [Vses. Nauchno-issled. Inst. Konservnoi i Ovoshchesushil'noi Promyshlennosti. USSR]

*Pseudomonas fluorescens* was the non-spore-forming bacteria which survived longest in canned fruit and vegetables produced in Georgia. Morphological, physiological and cultivation characteristics are given for the strain isolated from tinned cucumbers: it is more resistant to high temp. than stated in world literature on *Ps. fluorescens*. For that reason its resistance to the simultaneous application of sorbic acid and heat was tested. 0.1, 0.05, 0.025 and 0.01% of sorbic acid was added to the ampoules filled with 1 ml bacterial suspension ( $10^8$  cells/ml.). It was found that sorbic acid did not affect *Ps. fluorescens* without simultaneous heating. In a further series, the influence of sorbic acid (0.05, 0.025 and 0.01%) and simultaneous heating for 10, 15, 20, 25 min at 50°C; 10, 15, 20 min at 55°C; 5, 7, 10 min at 60°C was tested. Bacterial count was determined by culturing surviving bacteria on an agar meat medium containing 2% glucose. The results were compiled using mathematical statistical methods. The value D, i.e.

the heating time in min needed to reduce the number of microorganisms to a tenth was determined; further the value Z expressing the changes in the resistance of the microorganisms to heating under the influence of higher temp. The results show that sorbic acid in concn. of 0.05% and 0.025% does not exercise any significant influence on the reduction of D at 50°C, only a temp. rise to 55°C or 60°C reduced the D and Z values significantly. A 0.01% sorbic acid concn. gave

approx. the same results as heating at 50, 55 and 60°C without sorbic acid addition. It is obvious that sorbic acid affects *Ps. fluorescens* only in combination with higher temp. STI

6 J 1055

**Bok choy - reducing market losses.**

Anon.

*Agricultural Research (Washington)* 20 (7) 13 (1972) [En]

Investigation of bacterial soft rot and black spotting of Bok choy (Chinese chard or white cabbage) showed the presence of *Pseudomonas marginalis* and *Erwinia carotovora* in soft rotted tissue, but no microorganism in black spot. Fewer spots developed on diseased Bok choy stored at 32°F than at 38°F. RM

6 L 423

**[Biochemistry and uses of betaine from sugar beet.]**

Beitrag zur Biochemie und Verwendung des Rubeninhaltstoffs Betain. [A review] Steinmetzer, W.

*Zucker* 25 (2) 48-57 (1972) [138 ref. De, en, fr] [Amino GmbH, 3331 Frellstedt, German Federal Republic]

The occurrence of betaine in sugar beet (1.0-1.5% of DM) and other vegetable sources (wheat, barley, peas, lentils) is surveyed. Probable biosynthetic pathways in sugar beet, participation in transmethylation reaction in animal metabolism, practical use as feed supplement and growth-stimulating effect on chicks are reviewed. Other proposed uses include treatment for disorders of the liver, reduction of blood cholesterol during alcoholic gastritis, as stimulant of vitamin B<sub>12</sub> production by *Pseudomonas denitrificans* and as an antioxidant food additive. RM

6 M 637

**Studies on the microorganisms of cereal grain. XII. Taxonomic studies on a radio-resistant *Pseudomonas*.**

Ito, H.; Iizuka, H.

*Agricultural and Biological Chemistry* 35 (10) 1566-1571 (1971) [15 ref. En] [Japan Atomic Energy Res. Inst., Radiation Chem. Res. Establishment, Takasaki, Japan]

A radio-resistant *Pseudomonas* was isolated from samples of normal unpolished and commercial rice and accounted for most of the surviving microflora after irradiation with >0.2 Mrad. The species taxonomic characteristics were sufficiently





distinctive to warrant its description as a new species, *Ps. radora* nov. sp. Its radio-resistance was 10-40 times greater than that of e.g. *Ps. fluoresceus*. [See FSTA (1970) 2 4M266 for part X.] RM

6 R 306

**[Aetiological obscure food poisoning after consumption of mussels.]**

Rossebo, L.; Thorson, B.; Aase, R.

*Norsk Veterinaertidsskrift* 82 (11) 639-642 (1970) [9 ref. No]

Within a small area of the W. coast of Norway in Nov. 1968, a total of 15 persons fell ill on 3 different occasions after consumption of 15-50 steamed mussels (*Mytilus edulis* L.). Symptoms were nausea, vomiting, diarrhoea and prostration 3-7 h after ingestion of the mussels. The poisoning was reproduced in volunteers, but extracts from the mussels were non-toxic when injected into mice. On cultivation from toxic mussels on blood agar containing 3% NaCl, but not on ordinary blood agar, a haemolytic *Vibrio* or *Aeromonas* sp. appeared in large numbers when the plates were incubated at 20°C, but not at 37°C. Possible relation between toxic mussels and occurrence of the halophilic, haemolytic bacterium is discussed. AS

6 S 689

**Characterization of two psychrophilic *Pseudomonas* bacteriophages isolated from ground beef.**

Whitman, P. A.; Marshall, R. T.

*Applied Microbiology* 22 (3) 463-468 (1971) [18 ref. En] [Dept. of Food Sci. and Nutr., Univ., Columbia, Missouri 65201, USA]

As part of a study of phage-host interactions in refrigerated foods, preliminary studies were made with 2 psychrophilic phages wy and ps<sub>1</sub>, isolated from ground beef samples [see FSTA (1972) 4 3B24]. Phage inactivation by exposure to heat, low pH, osmotic shock conditions and freezing, showed that these 2 isolates were different. One-step growth experiments indicated that phage wy had a burst size five times as large (500) and a latent period twice as long (4 h) as ps<sub>1</sub> when tested at 7°C. Both phages contained 2-deoxyribonucleic acid. Electron micrographs showed that wy belonged to Bradley's phage group A and ps<sub>1</sub> to phage group C. MEG

6 T 374

**Pectolytic enzymes of exo-types. I. Oligogalacturonide transeliminase of a *Pseudomonas*.**

Hatanaka, C.; Ozawa, J.

*Agricultural and Biological Chemistry* 35 (10) 1617-1624 (1971) [27 ref. En] [Inst. for Agric. and Biol. Sci., Okayama Univ., Kurashiki, Japan]

Pectolytic enzymes of exotypes are studied with a view to possible utilization as juice clarifying and plant tissue macerating agents and for structural analysis of pectic substances. The purification and R properties of oligogalacturonide transeliminase (OGTE) from *Pseudomonas* sp. are described. The crude enzyme solution was purified 31 fold with

DEAE-Sephadex A-50. pH optimum with saturated and unsaturated digalacturonic acids was ~7.0, with acid-soluble pectic acid 6.4. Activity was max. with tetramer, followed by trimer, dimer and polymers. Saturated uronides were degraded a little more rapidly than unsaturated ones. Activity was considerably stimulated by 0.2-0.5 mM Ca<sup>2+</sup> ions. Both oxidized and reduced acid soluble pectic acids were resistant to the action of OGTE. The end product of OGTE action on oligo- and polygalacturonides was 4-deoxy-5-keto-D-glucuronic acid, with 4,5-unsaturated galacturonic acid a probable intermediate. RM

7 C 162

**[Test report on combined "Foxamin" detergent-sterilizer.] Untersuchungsbericht über das kombinierte Reinigungs- und Desinfektionsmittel "Foxamin".**

Hoffer, H.

*Milchwirtschaftliche Berichte aus den Bundesanstalten Wolfpassing und Rotholz* 1972 (30) 79-80 (1972) [De]

The nearly neutral combined detergent-sterilizer, "Foxamin", was found to be satisfactory as a detergent when used according to manufacturers' instructions in concn. 0.2-0.5%, by testing on different metal surfaces with respect to its cleaning and corrosive properties and as a sterilant by killing off various concn. of *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus faecalis*, *Mycobacterium phlei* and *Oospora lactis* in 2.5 min at 40°C or 5 min at 20°C. SAC

7 S 840

**A note on the aerobic microflora of fresh and frozen porcine liver stored at 5°C.**

Gardner, G. A.

*Journal of Food Technology* 6 (3) 225-231 (1971) [4 ref. En] [Ulster Curers' Assoc., 2 Greenwood Avenue, Belfast BT4 3JL, UK]

Comparative studies were made of frozen and unfrozen porcine livers stored either in air or in polyethylene bags at 5°C. Microbiological contamination was predominantly on the surface. Storage at 5°C in air resulted in a proteolytic type of spoilage caused by Gram-negative bacteria such as *Alcaligenes* spp. and *Pseudomonas* spp.; *Escherichia* spp., *Microbacterium thermosphactum*, and lactic streptococci were also detected. The level of contamination was higher in the 'drip' of samples stored at 5°C in polyethylene bags, and this appears to be related to the surface contamination of the liver; the souring type of spoilage when stored in a polyethylene bag, was associated with a predominance in the flora of lactic streptococci and *Leuconostoc* spp. Freezing was not found to change the spoilage characteristics. AB





7 S 934

[Occurrence of pseudomonads in meat and meat products and some properties of isolated strains.] Zum Vorkommen von Pseudomonaden in Fleisch und Fleischwaren sowie einige Eigenschaften dabei isolierter Stämme.

Lott, G.

**Health Physics 1971:** Special issue. Foods of animal origin 60-62 (1971) [13 ref. De] [Vet.-bakteriologisches Inst., Univ., Zürich, Switzerland]

The occurrence of *Pseudomonas* spp. in minced, chopped, and prepacked meat and liver from retail sources was examined. 50 samples (10-50 g) of product were examined for pseudomonad (Ps.) count, oxidase reaction, lipolysis, proteolysis and growth of Ps. at 0°C. Results are shown graphically and in tables. All the products were heavily contaminated with Ps., with heaviest load in minced and lowest in pre-packed meat. 9 samples of chopped liver also contained low levels of aeromonads, probably from washing water. The Ps. count on glutamate-starch-phenol red agar medium was confirmed by oxidase reaction. 97.5% of strains were psychrotrophic, able to grow for 14 days at 0°C. Lipolysis was not substrate specific and was not inhibited by Victoria Blue. Proteolysis was 86% positive for gelatin and 73% for milk protein, but only 0.2-0.4% for beef or pork meat. RM

7 T 388

[Antibacterial activity of sorbic acid.] Zur antibakteriellen Wirkung der Sorbinsäure.

Wallhäuser, K. H.; Lück, E.

**Deutsche Lebensmittel-Rundschau 68** (2) 39-44 (1972) [20 ref. De, en, fr] [Farbwerke Hoechst AG, Frankfurt (Main)-Höchst, German Federal Republic]

In view of the known anti-fungal effect of sorbic acid in preserved foods, its antibacterial effect was investigated. Liquid culture medium was inoculated with a bacterial suspension of  $10^6$  cells and the extinction read after 24 h incubation at pH 6 and 7 and the rate of growth compared with controls. Extinction curves were also plotted in relation to concn. of potassium sorbate and time (2-14 days). Inhibition of bacteria at 300-700 mg/ml was demonstrated. *Escherichia coli* and *Aerobacter aerogenes* required lower concn. than *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Least effect was exerted on *Lactobacillus arabinosus*. In no instance has sorbic acid enhanced bacterial growth. The results confirm that the antibacterial activity of sorbic acid is not of such universal character as its anti-fungal activity. Significant anti-bacterial activity, especially against bacterial flora of faecal origin, was nevertheless shown. OA

8 C 194

[Food hygiene.] Lebensmittelhygiene.

Anon. (Germany, W. Deutsche

Veterinärmedizinische Gesellschaft; Austria,

Österreichische Gesellschaft der Tierärzte)

**Alimenta 8** (2) 46-51; (3) 73-74 (1969) [De]

Resumes are given of papers read at the 12th Congress of the German Veterinary Association (Deutsche Veterinärmedizinische Gesellschaft) and the Austrian Association of Veterinary Surgeons (Österreichische Gesellschaft der Tierärzte) held in Salzburg in Oct. 1968. They include:

Refractometric determination of casein and total protein in milk, by F. Münchberg, R. Leskova & D. Svastics; Development of milk legislation with particular reference to hygiene, by - Wegener; Iodine content in milk in Austria, by R. Leskova & M. Weiser; Effect of vaccination against foot-and-mouth disease on the composition and processing characteristics of milk, by G. Terplan; Determination of psychrotrophic bacteria in producer's milk, by W. Heesch; Problems of milk and milk product analysis for *Salmonella* and *Shigella*, by K. Lang; Tests on the biological properties of pseudomonads of importance for milk hygiene, by G. Kielwein; Meat research from the chemist's viewpoint, by R. Hamni; Determination of prior heating in meat and meat products, by G. Pfeiffner & R. Böhm; Incidence of porphyrins in meat and meat products, by S. Wenzel; Meat ripening and blood lactic acid levels in slaughter pigs, by G. Hildebrandt; The need to evaluate the type of skin used in boiling sausages when interpreting the foreign moisture content, by U. V. Pieldner. [Continued in following abstr.] HBr

8 H 1173

The sulphur metabolism of brewing yeasts and spoilage bacteria.

Anderson, R. J.; Howard, G. A.; Hough, J. S. **Proceedings. European Brewing Convention 13:** 253-264 (1971, publ. 1972) [26 ref. En, de, fr] [Allied Breweries, Burton-on-Trent, UK]

Volatile S compounds including  $H_2S$ , dimethyl sulphide and thiols can contribute significantly to beer flavour. Therefore, formation of these volatiles by brewing yeasts and spoilage bacteria was studied. Brewing strains of *Saccharomyces cerevisiae* and *Sacch. carlsbergensis* formed varying amounts of  $H_2S$  and  $SO_2$  during continuous fermentation of wort and synthetic media. The yeasts did not form detectable amounts of volatile organo-sulphur compounds in synthetic media and only traces were produced in wort. Of the bacteria examined, *Enterobacter aerogenes* and *Obesumbacterium proteus* formed significant amounts of organo-sulphur volatiles and traces of  $H_2S$  during batch culture in wort.  $H_2S$  was the main S volatile detected in wort and beer infected with *Zymomonas anaerobia*. Formation of S volatiles in mixed cultures containing the bacteria and the 2 brewing yeasts was also examined. Some organo-sulphur volatiles formed by bacteria were identified and their biosynthesis is discussed in the light of experiments with  $^{35}S$ -labelled precursors. The results suggest that, although yeasts and bacteria can form  $H_2S$ , bacteria are mainly responsible for the potentially more important volatile organo-sulphur compounds in beer. AS





8 H 1204

**Brewery spoilage micro-organisms.**

Richards, M.

**Brewers' Digest** 47 (2) 58-59 & 62-64 (1972) [21 ref. En] [Bass Production, Ltd., Burton-on-Trent, Staffordshire, UK]

The restricted range of bacteria capable of causing problems in a brewery include

*Obesumbacterium proteus*,*Acetobacter*/*Acetomonas*, *Zymomonas*,*Lactobacillus* und *Pediococcus* spp. Tests for genus

and species identification are briefly described and

evaluated. Difficulties of identifying yeast

contaminants, particularly wild *Saccharomyces*,

have been eased by the introduction of the immuno-

fluorescent technique, which is discussed. The main

advantage of this method is that results can be

available the same day instead of after 2-7 days

(necessary for most microbiological tests).

Membrane filtration will probably be used to

concentrate cells before the immuno-fluorescent

method is carried out. A micro-colony method can

be used to accelerate membrane filtration and aid

identification of yeasts. PG

8 H 1225

**[Inoculated tea beverage.]**

Meito Sangyo Co. Ltd.

**Japanese Patent** 8985/72 (1972) [Ja]

A liquid culture medium containing water-soaked raw or processed tea leaf is inoculated and aerobically cultured with either an acid-producing *Aspergillus* or an oxidizing microorganism such as *Gluconobacter* or *Acetobacter*. IFT

8 H 1226

**[Inoculated tea beverage.]**

Meito Sangyo Co. Ltd.

**Japanese Patent** 8986/72 (1972) [Ja]

See preceding abstr.

8 S 981

**[Influence of spin-chiller cooling on the surface bacterial count of broiler chickens.]**

Untersuchungen über die Beeinflussung des Oberflächenkeimgehaltes von Schlachthähnchen durch die Spinchiller-Kühlung.

Peric, M.; Rossmann, E.; Leistner, L.

**Fleischwirtschaft** 51 (2) 216-218 (1971) [15 ref.

De, en] [Inst. für Bakteriologie und Histologie,

Bundesanstalt für Fleischforschung, Kulmbach,

German Federal Republic]

The bacterial count of broilers was investigated at a commercial poultry slaughterhouse using a spin-chiller with a throughput of ~3000 broilers/h and 1.5, 3.0 or 4.5 l. washing water/broiler. Depending on the amount of water used and the initial contamination, spin-chilling caused an initial decrease and later an increase through the day in surface counts. With 1.5 l. washing water and relatively high initial contamination, the washing effect lasted 90 min. with 3 l. water and clean material 6 h, with 4.5 l. and high contamination 4

h. Even under favourable conditions, reduction in surface contamination was much less after spin-chilling than after spray-cooling. The % of cytochrome oxidase-positive microorganisms (chiefly *Pseudomonads*) increased from an initial 4% to 30-50% with spin-chilling but remained at 3-7% after spray-cooling. RM

8 S 999

**[Ability of microorganisms occurring in meat and meat products to form porphyrins.]**

Untersuchungen über das

Porphyrinbildungsvermögen von in Fleisch und Fleischwaren vorkommenden Mikroorganismen.

[A thesis]

Müller-Prasuhn, G.

58pp. (1969) [58 ref. De] Hanover, German Federal Republic: Tierärztliche Hochschule

13 spp. of Enterobacteriaceae, 2 of

*Pseudomonadaceae*, 10 of *Bacillaceae*, 8 of*Lactobacteriaceae* and 2 of *Micrococcaceae*, 28 of

which were from the collection of the Veterinary

High School in Hanover and 7 from the collection

of the Robert Koch Institute in Berlin, were tested

as pure or mixed cultures on different media for

ability to synthesize porphyrins or form them from

myoglobin precursors. The findings are presented

in detail. SKK

9 H 1472

**[Microbiological analysis during shochu production.**

III. Microflora of the mash made of uncooked white rice bran and a koji prepared with uncooked white rice bran.]

Tamaoka, T.; Tanabe, I.; Kobayashi, T.; Obayashi, A.; Matsumura, E.

**Journal of the Society of Brewing, Japan [Nihon****Jozo Kyokai Zasshi]** 66 (9) 893-896 (1971) [7

ref. Ja] [Res. Inst. Brewing, Takinogawa, Kita-ku,

Tokyo, Japan]

Uncooked white rice bran (WRB) was mixed with a suitable amount of hot water and inoculated with *Aspergillus kawachii* to make a koji preparation. During preparation of the koji, *Brevibacterium*, *Pseudomonas*, *Aerobacter*, and *Bacillus* spp. which had existed in the raw WRB increased to  $5 \times 10^{10}$ /g. Acid-labile lactic acid bacteria (LAB), such as *Leuconostoc* and *Candida* spp., were also found in the koji preparation ( $\sim 2 \times 10^4$ /g), but most were reduced in numbers during moto mash incubation. In the second mash, which was prepared by addition of raw WRB to the moto mash, heterofermentative LAB such as *Leuc. betadelbrückii* and *Leuc. buchneri* increased to  $1.1 \times 10^5$ /ml. In the third mash, which was prepared by adding raw WRB to the second mash, homofermentative LAB, such as *Lactobacillus acidophilus*, predominated, amounting to  $2.4 \times 10^5$  ml. Mash showing bacterial growth was susceptible to spoilage. [See preceding abstr.] YN





9 H 1475

[Method for continuous cold sterilization of wine using electrophysical procedures.]

Avakyan, B. P.

*Prikladnaya Biokhimiya i Mikrobiologiya* 5 (5) 601-606 (1969) [10 ref. Ru, en] [Inst. of Viticulture, Winemaking & Horticulture, Erevan, USSR]

A water-cooled hermetically sealed chamber is described in which a static or flowing layer of wine is exposed under inert gas to ultrasonic radiation from 4 magnetostrictive generators in the bottom part of the chamber and to UV radiation from 8 lamps suspended from the roof. Optimal conditions of sterilization established in experiments with *Lactobacillus plantarum*, *Acetobacter aceti*, *Saccharomyces vini* and wild yeasts added in pure culture to pasteurized must or wine were: irradiation time, 5-9 sec; wine layer thickness, 2.5-5 mm; throughput, 400-600 l/h; UV intensity, 40 000-90 000 erg/mm<sup>2</sup>; ultrasonic radiation, frequency 20 kHz, anode tension 7.3 kV. Continuous treatment proved more effective than batch treatment. Contaminated commercial wines of different types were (i) pasteurized or (ii) treated by cold sterilization. Marked increase in numbers of microorganisms occurred in (i) 15-20 days after treatment, whereas wines subjected to (ii) were sterile after 2 months. No differences were found between (i) and (ii) in titratable acidity, contents of volatile acids, alcohol, sugars or aldehydes; (ii) caused some reduction in contents of tannins and pigments and replacement of glycolic acid by fumaric acid. Taste, bouquet and stability of (ii) treated wines were better than of (i) treated wines. SKK

9 M 1022

[Study of radio-pasteurization. VIII. Radiosensitivity of "red *Pseudomonas*" and its recovery from radiation damage.]

Ito, H.; Watanabe, H.; Iizuka, H.; Okazawa, Y. *Food Irradiation [Shokuhin-Shosha]* 6 (1) 43-46 (1971) [4 ref. Ja, en] [Japan Atomic Energy Res. Inst., Takasaki Radiation Chem. Res. Establishment, Japan]

A radio-resistant bacteria, which has been called "red *Pseudomonas*", was isolated from samples of normal rice and commercial rice. The dose at D<sub>10</sub> value of the strain No. 0-1 was 0.14 Mrad in aerial condition which is similar to that of *Micrococcus radiodurans*, and that of the strain No. RP-C was 0.06 Mrad in 0.067M phosphate buffer. The activity of O<sub>2</sub> removal was the major mode of protection, and radioresistance of cells under vigorously bubbling air increased considerably when irradiated. This species could partially recover from the lethal effects of gamma rays at post-incubation temp. of from 20 to 40°C. Irradiated cells have a higher rate of recovery in a minimal medium than a nutritive medium. AS

9 P 1253

Abstracts for papers to be presented at the sixty-seventh annual meeting, Virginia Polytechnic Institute and State University, Blacksburg, July 26-29, 1972. Manufacturing section. [Chemistry.] United States of America, Dairy Science Association

*Journal of Dairy Science* 55 (5) 660, 666 & 677-678 (1972) [En]

Abstracts in this section concerning milk composition and quality include the following: Effect of vitamin fortification on development of oxidized flavour in autooxidative milk, by A. Patel & M. Loewenstein (M6); Identity of the musty-potato aroma compound in milk cultures of *Pseudomonas taetrolens*, by M. E. Morgan, L. M. Libbey & R. A. Scalan (M33); Protein changes in relation to lipase activity and flavours in milk, by M. S. Borges & J. B. Mickle (M80); Flavour of milk from cows fed vegetable oils coated with formaldehyde-treated caseinate, by L. F. Edmondson, F. W. Douglas, Jr., N. H. Rainey & H. K. Goering (M83); Physical and chemical properties of milk fat from cows fed vegetable oils coated with formaldehyde-treated caseinate, by R. A. Yoncoskie, N. H. Rainey, L. F. Edmondson & J. Bitman (M84); and Oxidized flavour in milk from cows supplemented with formaldehyde-treated casein-safflower oil particles, by R. L. King, R. Gaither, R. Singh, J. Bitman, H. K. Goering & T. R. Wrenn (M89). SAC

9 P 1257

Abstracts of paper to be presented at the sixty-seventh annual meeting, Virginia Polytechnic Institute and State University, Blacksburg, July 26-29, 1972. Manufacturing section. [Bacteriology.] United States of America, Dairy Science Association

*Journal of Dairy Science* 55 (5) 668-669 & 671-672 (1972) [En]

Abstracts in this section concerned with bacteriological aspects of cheesemaking include the following: Lyophilized lactic starter concentrates: evaluation for use in direct cheese milk inoculation, by C. A. Speckman, E. R. Vedamuthu, W. E. Sandine & P. R. Elliker (M44); Adsorption of *Pseudomonas fluorescens* on Cottage cheese curd - influence of pH, by E. K. Wellmeyer & R. T. Marshall (M45); Behaviour of enteropathogenic strains of *Escherichia coli* during manufacture of Camembert cheese, by H. S. Park, E. H. Marth & N. F. Olson (M48); Effect of partially culturing skim-milk on body and texture of direct-acid Cottage cheese, by C. G. Kale, G. Y. Vahora & C. A. Ernstrom (M57); and LFE Bioenhancer for Cheddar cheese manufacturing, by A. M. Beery, T. Kristoffersen & K. R. Nath (M59). SAC





9 P 1365

[Heat resistance of *Pseudomonas fluorescens* proteases.] Die Hitzeresistenz der Proteasen aus *Ps. fluorescens*.

Knaut, T.; Mech, H.

*Milchwissenschaft* 27 (3) 167-170 (1972) [12 ref. De, en] [Katedra Inżynierii i Aparatury Przemysłu Spożywczego, WSR, Olsztyn, Poland]

A strain of *Pseudomonas fluorescens* was inoculated into reconstituted dried [skim-]milk (10% TS) and incubated at 6-8° or 25°C for 5 days; after centrifugation at  $12\,000 \leq g$  for 30 min, the supernatant was heated at 63°C for 5-30 min, 75°C for 2-10 min, 85°C for 1-10 min or 100°C for 1-10 min, then added at 1% to reconstituted milk, and amino N was determined after 5 days at 6-8, 18 or 25°C. Degree of inactivation of proteases increased progressively with increase in severity of temp./time conditions. There was little inactivation at 63°C, ~50% inactivation after 10 min at 75°C, ~70% after 5 min at 85°C, and complete inactivation after 5 min at 100°C. SKK

9 R 442

Microflora of fresh and stored flatfish, *Kareius bicoloratus*.

Simidu, U.; Kaneko, E.; Aiso, K.

*Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi]* 35 (1) 77-82 (1968) [12 ref. En] [Inst. of Food Microbiol., Chiba Univ., Izumi-cho, Narashino-shi, Chiba-ken, Japan]

Flatfish (*Kareius bicoloratus*) microflora was examined in fresh samples and samples stored at 2°C for 7 and 14 days. The samples taken were from back middle skin (9 cm<sup>2</sup>), 10 g underlying muscle, gills and intestines; there were homogenized with a diluent of 1.0% KCl and 0.8% NaCl and serial dilutions were plated out (composition of medium is given). After counting plates, 30 colonies were picked for detailed examination of the flora. Sets of plates were incubated for 4 days at 20°C and 14 days at 2°C. Viable counts and composition of the flora are tabulated for different parts of the fish and storage periods at the 2 temp. concerned. Significant differences were found between the skin flora and that of the gills and guts. Main constituents of the skin flora were *Pseudomonas* and *Achromobacter*, whereas in gills and guts *Vibrio* and *Aeromonas* predominated; the former were able to grow at 20°C but many of the *Vibrio/Aeromonas* group were unable to grow at 20°C and had an optimum growth temp. around 15°C. The differences remained throughout storage. *Vibrio* spp. are a main constituent of the flora of inshore sea water around Japan and are shown to occur in large number in fish stored at low temp. ELC

9 T 519

[Acetic acid bacteria and their utilization. I. Classification of acetic acid bacteria isolated from vinegar mash.]

Yanagida, F.; Ishizuka, I.; Yamamoto, Y.; Nishijima, H.; Suminoe, K.

*Journal of the Society of Brewing, Japan [Nihon Jozo Kyokai Zasshi]* 66 (10) 991-996 (1971) [32 ref. Ja, en] [Dept. Brewing, Univ. Agric., Sedagaya-ku, Tokyo, Japan]

49 strains of acetic acid bacteria were isolated from the mashes of both continuous and batch (quick fermenting) culture. They were classified by Bergey's method as *Acetobacter aceti* (26 strains), *Acetobacter pasteurianus* (13 strains), *Acetobacter rancens* (3 strains) and *Acetobacter kuetzingianum* (1 strain). The remaining 6 strains, *Acetobacter xylinum*, were detrimental to the vinegar-making process. YN

10 H 1561

[Studies on the microflora of takju brewing.]

Lee, Z. S.; Rhee, T. W.

1558df 8 (3) 116-133 (1970) [73 ref. Ko, en] [Dept. of Biol., Coll. of Education, Seoul Nat. Univ., Korea]

A microflora survey was made of kokja (starter) and takju (Korean rice wine). The following microorganisms were identified in kokja: *Mucor*, *Rhizopus*, *Aspergillus* (moulds); *Saccharomyces*, *Pichia*, *Candida*, *Torulopsis*, *Hansenula* (yeasts); *Micrococcus*, *Bacillus*, *Aerobacter*, *Pseudomonas* (bacteria). In takju, the major organisms found were: *Micrococcus*, *Bacillus subtilis*, *B. megatherium*, *Pseudomonas*, *Salmonella*, *Streptococcus*, *Escherichia*, and sake yeasts. KoSFoST

10 R 502

Biochemical mechanism of psychrotrophism in a marine *Pseudomonas* isolated from English sole (*Parophrys vetulus*).

Zachariah, K.

*Dissertation Abstracts International. Section B. The Sciences and Engineering* 32 (11) 6460: Order no. 72-15 166 (1972) [En] [Univ. of Washington, Seattle, 98105, USA]

Psychrotrophism in *Pseudomonas* Ps-70 isolated from English sole was investigated; alanine was used as the only C and N source in the culture media. Cells grown at 2°C and 22°C contained alanine oxidase (AO) isozymes differing in temp. and pH optima, heat sensitivity and gel-filtration and dialysis characteristics; the results suggest that the mesophilic enzyme synthesis starts at a growing temp. of ~10°C. In a second experiment, the low-max. growth temp. of *Pseudomonas* Ps-70 was investigated. Results indicated that the AO system, endogenous respiration and protein synthesis did not limit the max. growth temp. Alanine transport, however, practically ceased after heating at 35°C for 30 min. Heating caused greater damage to the cell membrane of cells grown at 2°C than to that of cells grown at 22°C, suggesting differences in molecular architecture and biochemical composition. *Pseudomonas aeruginosa*, a typical mesophile, could not respire endogenously, transport alanine or synthesize protein at temp. below its min. growth temp. AJDW





10 S 1251

[Lactobacilli and closely related microorganisms in meat and meat products. VII. Products of carbohydrate metabolism and their antagonism towards saprophytic and enterotoxic microorganisms.] Laktobazillen und eng verwandte Mikroorganismen in Fleisch und Fleischwaren. VII. Kohlenhydratstoffwechselprodukte und antagonistische Aktivitäten gegenüber saprophytären und enterotoxischen Mikroorganismen.  
Reuter, G.

*Fleischwirtschaft* 51 (8) 1237-1242 & 1245 (1971) [28 ref. De, en, fr] [Inst. für Lebensmittelhygiene, Freie Univ., 1000 Berlin 33, Bitterstrasse 8-12, German Federal Republic]

Quantitative determination of major carbohydrate breakdown products produced by representative strains in liquid culture showed these to be lactic and acetic acids and CO<sub>2</sub> from heterofermentation. Thermobacteria and streptobacteria were strong acid formers producing 0.8-1.5% lactic acid, atypical streptobacteria and heterofermentation species were weaker, producing 0.3-0.8% lactic acid. Acetic acid comprised only 0.023-0.05% by homofermentative and 0.114-0.143% by heterofermentative strains; no aldehydes or diacetyl and only traces of pyruvic acid were found. The antagonistic effect of lactobacilli on other food microorganisms (enterococci, micrococci, bacilli, pseudomonads and enterobacteria) was tested by the agar cup method using centrifuged culture fluid, and by the suspension test comparing competitive growth. The activity of different lactobacilli varied directly with their lactic acid formation. Acetic acid was not present in sufficient concn. to exert inhibition. No H<sub>2</sub>O<sub>2</sub> was found in any Lactobacillus culture to account for greater inhibition of some strains than was attributable to lactic acid formation. Lactic acid did not build up until the logarithmic growth phase and reached max. concn. in the stationary phase; consequently there could be an initial vigorous growth of their microorganisms, especially with high contamination. RM

10 S 1310

[Investigations into the cause of lipolysis in dry sausages using models.] Orientierende Untersuchungen über die Ursache der Lipolyse bei Rohwürsten mit Hilfe von Modellen.  
Lubieniecki-v. Schelhorn, M.

*Fleischwirtschaft* 52 (1) 72-75 (1972) [7 ref. De, en, fr] [Inst. für Lebensmitteltech. & Verpackung, 8000 Munich 50, Schragenhofstrasse 35, German Federal Republic]

The origin and course of lipolysis during ripening and storage of dry sausages was investigated with model products using: (i) largely sterile preparation, immediate freeze-drying, storage at equilibrium RH 63.5%; (ii) as (i) but with  $\gamma$ -irradiation (1.77 Mrad) before storage; (iii) inoculation with *Pseudomonas aeruginosa*, 6 days ripening, then freeze-drying and storage; (iv) as (iii) but with  $\gamma$ -irradiation. Products were stored up to 121 wk. Lipolysis, followed by increase in acid

number, went on for >95 wk in all samples. ~19-31% of total lipolysis was due to tissue lipases of the raw material. Increased storage life could be achieved by reducing the amount of bacterial lipases through control of ripening. RM

10 S 1431

Influence of the growth of psychrophilic microorganisms on the flavour and selected chemical components of chicken meat.  
Mast, M. G.

*Dissertation Abstracts International. Section B. The Sciences and Engineering* 32 (7) 3997: Order no. 72-4562 (1972) [En] [Ohio St. Univ., 190, North Oval Drive, Columbus, 43210, USA]

Meat was aseptically procured from 8 wk old broiler chickens reared under commercial conditions and samples were inoculated with an *Alcaligenes* sp. a *Flavobacterium* sp. or *Pseudomonas putrefaciens*, and stored at 3°C for  $\leq 14$  days. Over 14 days storage, uninoculated chicken breast meat maintained a pH of 6.33, whereas samples inoculated with either *Alcaligenes* sp. or *Ps. putrefaciens* increased in pH to 8.9 and 7.95, respectively. ~35 peaks were detected with a gas chromatograph from the volatiles in the headspace vapour of chicken meat. The concn. of headspace volatiles usually increased with storage until spoilage began and then decreased. In the inoculated samples, those with high concn. of volatile compounds recieved ratings by the taste panel superior to those given to samples with low concn. of volatiles. The total concn. of volatile carbonyl compounds tended to increase with storage time until spoilage occurred, and then began to decrease. 18 fatty acids were detected and tentatively identified in chicken breast meat. The proportion of fatty acids, up to and including stearic acid (C-18 saturated) tended to increase with storage time; this change being particularly pronounced as spoilage occurred in the chicken meat. AB

11 C 268

[Test report on combined detergent-disinfectant "Diokem".] Untersuchungsbericht über das kombinierte Reinigungs- und Desinfektionsmittel "Diokem".

Hoffer, H.

*Milchwirtschaftliche Berichte aus den Bundesanstalten Wolfpassing und Rotholz* 1972 (31) 157-158 (1972) [De] [Bundes-Lehr- und Versuchsanstalt für Milchwirtschaft, Wolfpassing, Austria]

'Diokem' combined detergent sterilizer (pH, ~12) composed mainly of alkali carbonates, anhydrous phosphates and silicates with other detergents and containing an organic active Cl<sub>2</sub> source, was found to be satisfactory as a detergent, and was non-corrosive, when used at 50°C in 2% concn. on various metal surfaces. It was also a satisfactory sterilizing agent at 0.5-2% concn. against *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Mycobacterium phlei* and *Geotrichum candidum*. 'Diokem' is recommended for dairy use. SKK





11 B 107

[Effect of irradiated sugar solutions on the growth of microorganisms (*Escherichia coli*, *Pseudomonas fluorescens*).]

Namiki, M.; Kawagishi, S.

*Food Irradiation [Shokuhin-Shosha]* 4 (1) 35-41 (1969) [11 ref. Ja, en] [Dept. of Food Sci. & Tech., Nagoya Univ., Chikusa-ku, Japan]

11 G 549

Effects of dehydration through the intermediate moisture range on water activity, microbial growth, and texture of selected foods.

Chordash, R. A.; Potter, N. N.

*Journal of Milk and Food Technology* 35 (7) 395-398 (1972) [16 ref. En] [Dept. of Food Sci., Cornell Univ., Ithaca, New York 14850, USA]

Various food systems (partially dehydrated custard, beef, pea and ham products) were inoculated with *Pseudomonas aeruginosa* and *Staphylococcus aureus* and vacuum-dried to different moisture contents in the intermediate moisture range. Water activity ( $a_w$ ) values were determined instrumentally with a hygrometer indicator equipped with appropriate hygrosensors. Sorption isotherms and bacterial growth curves at the various water activities were plotted and correlated with food texture. Growth of *Ps. aeruginosa* was inhibited at  $a_w$  test values below 0.98, 0.98, and 0.96 in custard, pea, and beef products, respectively, and growth of *Staph. aureus* did not occur below  $a_w$  test values of 0.94 and 0.96 in custard and ham products, respectively. These results generally agree with earlier work done on model systems. With none of the foods studied could microbiologically stable intermediate moisture products of acceptable texture be produced by drying alone. AS

11 H 1749

[Bacterial recontamination of drinking and industrial water. I. The influence of ion-exchange plants.] Zur Frage der Nachverkeimung von Trink- und Brauchwasser, I. Der Einfluss von Ionenaustauscheranlagen.

Schubert, R. H. W.; Esanu, J.

*Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, I. Abteilung, Originale, Serie B* 155 (5/6) 488-501 (1972) [9 ref. De, en] [Hygiene-Inst., Johann Wolfgang Goethe Univ., Frankfurt a. M., German Federal Republic]

Bacterial growth may occur in intermittently used ion-exchange systems, but continuous or frequent use of the systems limits or prevents bacterial growth. Model experiments demonstrated that the growth is due to the large surface area of the ion-exchanger bed rather than the chemical nature of the material, since a similar phenomenon occurs in quartz beds. *Pseudomonas acidovorans* and *Ps. fluorescens* propagated preferentially, while numbers of *Ps. maltophilia* declined. Gram-positive

bacteria of tap water multiplied less rapidly than the *Pseudomonas* spp. The method of regeneration of the ion-exchanger bed does not influence bacterial recontamination. Beds can be disinfected provided that the period of contact of the disinfectant with the exchanger is considerably longer than the usual contact time of the regenerant with the exchanger. DSW

11 M 1248

[Studies on radio-pasteurization. VI. Radio-sensitivity and taxonomic study of red *Pseudomonas* isolated from rice.]

Ito, H.; Iizuka, H.; Watanabe, H.; Shibabe, S.

*Food Irradiation [Shokuhin-Shosha]* 5 (1) 61-70 (1970) [6 ref. Ja, en]

11 P 1766

Effect of a heat-stable protease from *Pseudomonas fluorescens* on the shelf-life of dairy products.

White, C. H.

*Dissertation Abstracts International. Section B. The Sciences and Engineering* 32 (9) 5240-5241: Order no. 72-10 675 (1972) [En] [Univ. of Missouri, Columbia, USA]

A heat-stable protease was isolated from *Ps. fluorescens* P26, purified and characterized. The enzyme increased proteolysis (detected by the Hull test which measures  $\mu\text{g}$  tyrosine and tryptophan released/ml) of Cheddar and Cottage cheeses when added to the cheesemilk 12 h prior to manufacture. It did not affect flavour of Cheddar cheese, but Cottage cheeses had significantly lower flavour scores ( $P < 0.01$ ) than had controls. Hull values tended to increase as flavour scores decreased. Hull values of HTST pasteurized milk were not affected by addition of protease or *Ps. fluorescens* prior to pasteurization, but increased ( $P < 0.01$ ) when protease was added after treatment. Values in UHT-treated milk were significantly higher when *Ps. fluorescens* was added to grade A raw milk 5 days prior to treatment. The protease had no significant effect on shelf-life of butter or ice cream. CDP

11 R 655

[Microbiological and enzymological studies on the flavoured components of sea food pickles.]

Lee, K. H.

1551ci 11: 1-27 (1969) [79 ref. Ko, en] [Dept. of Food Tech., Coll. of Agric., Seoul Nat. Univ., Suwon, Korea]

Korean sea food pickles; salted, yellow tail pickle, clam pickle, oyster pickle, and cuttlefish pickle, were analysed for components, main fermenting microbes and enzyme characteristics. 14-30 mg/ml acidic amino acids were found in salted clam pickle, 0.7-4.60 mg/ml basic amino acids in salted yellow tail pickle, 7.9-21.5 mg/ml sulphur containing amino acids in salted cuttlefish pickle, and 17.6-31.1 mg/ml essential amino acids in salted oyster pickle. The microflora observed were *Micrococcus*, *Brevibacterium*, *Sarcina*,





Leuconostoc, Bacillus, Pseudomonas and Flavobacterium. Enzyme activity found included: protease of fermenting microbes, RNA-depolymerase, 5-phosphodiesterase, and Bacillus phosphodiesterase. KoSFoST

12 H 1906

[Sterilizing doses of ultraviolet rays and ultrasonic waves used to treat the basic microflora of wine.]

Avakyan, B. P.

*Biologicheskii Zhurnal Armenii* 24 (1) 90-94 (1971) [12 ref. Ru] [Inst. Vinogradarstva, Vinodeliya i Plodovodstva MSCH ArmSSR, USSR]

Tests were made of the effect of the title treatments on *Saccharomyces vini*, *Hanseniaspora apiculata*, *Torulopsis utilis*, *Candida mycoderma*, *Lactobacterium plantarum* and *Acetobacter aceti* isolated from local wines. Differential tests of ultraviolet rays and ultrasonic waves showed that different doses of radiation or ultrasound produced a different bactericidal effect. High doses of X-rays led to inactivation of the microorganisms investigated. The biological effect of inactivation of microorganisms and changes in chemical composition and sensory properties were also investigated. STI

12 H 1912

[Microflora during sparkling wine production.]

Avakyan, S. P.; Avakyan, B. P.

*Biologicheskii Zhurnal Armenii* 24 (5) 45-50 (1971) [21 ref. Ru] [Vses. Zaochnyi Inst. Pishchevoi Promyshlennosti, USSR]

The microflora was studied of raw materials for wine and sparkling wine, using samples taken from all sections of the technological process. Results revealed the presence of wine and other types of yeasts (*Hansenula apiculata*, *Saccharomyces ludwigii*, *Candida mycoderma*), along with lactic acid bacteria (*Lactobacillus plantarum*, *L. brevis*, *L. buchneri*) and acetic acid bacteria (*Acetobacter aceti*, and *A. ascendens*). Pasteurization at 65°C for 3 h with subsequent filtration considerably reduced the numbers of the above microorganisms. Genera of isolated yeast cultures were determined from morphological, physiological and biochemical properties. STI

12 P 1774

[Improved nitrate reduction test.] Eine verbesserte Nitratreduktionsprobe.

Rapp, M.; Münch, S.; Prinz, I.; Enkelmann, D. *Milchwissenschaft* 27 (6) 355-360 (1972) [15 ref. De, en] [St. Milchwirtschaftliche Lehr- und Forschungsanstalt, Dr. Oskar Farny-Inst., Wangen im Allgäu. German Federal Republic]

A modified nitrate reduction test is described in which increased sensitivity and rapidity (2 h incubation at 37°C suffices) were achieved by addition of aqueous yeast extract to the reagent. A comparison with methylene blue and resazurin tests made on 323 raw milks showed the nitrate reduction test to be superior to both for quality control, placing only 59.5% of the milks (average bacterial count of 680 000/ml) in class I as against

71% (average count 840 000/ml) with the methylene blue and 84% (average count 991 000/ml) with the resazurin test. Milks with high numbers of coliforms and non-acidformers, the organisms which characterize the modern machine-milked and refrigerated product were more readily detected by the nitrate reduction test. Of 18 strains of bacteria commonly found in raw milk 6 (all coli-aerogenes group) reduced nitrate strongly, 5 (*Staphylococcus*, *Aeromonas*, *Proteus* and *Serratia* spp.) moderately and 7 (*Salmonella*, *Staphylococcus*, *Streptococcus* and *Pseudomonas* spp.) weakly. GTP

12 P 1914

Suitability of four different media for the enumeration of pseudomonads in milk.

Driessen, F. M.; Stadhouders, J.

*Netherlands Milk and Dairy Journal* 26 (2) 91-99 (1972) [10 ref. En, nl] [Inst. for Dairy Res. (NIZO), Ede, The Netherlands]

None of the following 4 media appeared to be sufficiently selective for enumerating pseudomonads and aeromonads only: ammonium lactate/crystal violet (ALCV) agar [Gyllenberg et al., *Acta Agric. scand.* (1960) 10: 65]; glutamate/starch/phenol red agar [FSTA (1969) 1 11B338]; Masurovsky medium [J. Bact. (1963) 85: 722], and Herellea-Pseudomonas medium (containing arginine, NaCl, K<sub>2</sub>HPO<sub>4</sub> and chloramphenicol). Development of pseudomonads was inhibited on all media except ALCV agar, on which coli-aerogenes and *Alcaligenes* spp. also grew well. However, the number of oxidase-positive colonies developing on ALCV agar could be taken as a fairly good measure of the pseudomonads present providing that the interfering strains were not so numerous in the sample as to dilute out the oxidase-positive organisms. CDP

## VOLUME 5

1 B 2

Extracellular microbial polysaccharides: new hydrocolloids having both fundamental and practical import.

Jeanes, A.

*Abstracts of Papers, American Chemical Society* 164: ORPL 82 (1972) [En] [N. Regional Res. Lab., 1815 North University Street, Peoria, Illinois 61604, USA]

The polyanionic heteropolysaccharide xanthan, produced from corn sugar by *Xanthomonas campestris* NRRL B-1459, is used as a thickening, stabilizing and suspending agent in foods. Fundamental and practical significance of this and various other hydrocolloidal, extracellular, microbial polysaccharides is discussed with reference to: viscosity and factors influencing it; rheology; water-binding capacity; compatibility or interaction with organic solvent salts; and other





polysaccharides; birefringence in stationary or flowing solutions; and molecular configuration and interaction of these macromolecules in "solution" or dispersion. **AA**

1 B 9

[Selective medium for enrichment of *Pseudomonas aeruginosa* from mixed populations.] Selektives Medium zur Anreicherung von *Pseudomonas aeruginosa* aus Mischpopulationen.

Abdou, M. A.-F.

*Chemie Mikrobiologie Technologie der Lebensmittel* 1 (Mar.) 81-88 (1972) [45 ref. De, en, fr] [Abteilung Qualitätskontrolle, Mikrobiol. Lab. der Firma C. H. Boehringer Sohn, Ingelheim/Rhein, Federal Republic of Germany]

100 strains of *Ps. aeruginosa* and 145 strains of 46 other species were included in a study to develop a selective medium to enrich *Ps. aeruginosa*. Adipic acid-Sebacic acid-Ampholyte KKP 70-Bouillon proved suitable for this purpose. 2 media known to enhance the formation of fluorescein and pyocyanin have been modified so that only *Ps. aeruginosa* is able to grow on them. A scheme for the isolation and detection of *Ps. aeruginosa* was developed. The method can be applied to foods. **AS**

1 K 5

Isolation and characterization of microorganisms involved in the fermentation of Trinidad's cacao beans.

Ostovar, K.

1143bc 33 (1) 344: Order no. 72-19 360 (1972) [En] [Pennsylvania St. Univ., University Park, USA]

The microflora of cocoa beans fermenting in sweat-boxes at (i) Centeno Estate, (ii) San Louis Estate and (iii) The University of West Indies was investigated. Samples were taken at depths of 5, 45 and 90 cm at intervals during fermentation periods of  $\leq 7$  days. 256 pure cultures were isolated, and 10 families, 26 genera and 54 species were isolated. Initial and final microbial counts were, respectively: (i)  $1.48 \times 10^5$ /g and  $4.1 \times 10^5$ /g; (ii)  $6.8 \times 10^5$ /g and  $9.2 \times 10^5$ /g; and (iii)  $2.6 \times 10^5$ /g and  $1.3 \times 10^7$ /g. The initial microflora was dominated by yeasts. As fermentation progressed, *Zymomonas mobilis*, *Lactobacillus* spp., *Streptococcus thermophilus*, *Acetobacter roseus* and *Bacillus* spp. dominated in (i), *Streptococcus thermophilus* and *Bacillus* spp. dominated in (iii), and *Pseudomonas* spp., *Aerobacter aerogenes* and *Escherichia coli* dominated in (ii), resulting in the appearance of undesirable odours. The microflora of dried and polished cocoa beans consisted largely of *Bacillus* and *Micrococcus* spp.; the microflora of fruit flies (*Drosophila melanogaster*) and dried pulp from sweat boxes correlated closely with that of fermenting cocoa beans. **AJDW**

1 R 59

[Effect of irradiation and preservatives on the keeping quality of fish fillets. II. Changes in the

microflora of irradiated and preservative-treated fish fillets during storage at 0°C.]

Kawabata, T.; Kozima, T.; Okitsu, T.

*Food Irradiation [Shokuhin-Shosha]* 3 (1) 40-48 (1968) [12 ref. Ja, en]

Microflora changes in irradiated (0.1 Mrad) and preservative-treated northern halibut and big-eyed tuna fillets during aerobic (packaged in thin polyethylene film) storage at 0°C were determined. Fillets were treated with chlortetracycline (CTC, 10 ppm), furylfuramide (FF, 5 ppm), or tylosin (TL, 10 ppm). Half were irradiated with  $^{60}\text{Co}$   $\gamma$ -rays. All samples were stored at 0°C for 0, 3 and 6 wk. The majority of surviving and growing organisms in the untreated control and preservative-treated fillets were *Pseudomonas*. Micrococci and other Gram-positive organisms in the CTC- and FF-treated samples declined during storage. Gram-positive organisms, especially yeasts, become predominant after irradiation of halibut fillets. The organisms become particularly predominant in CTC-treated fillets. The flora of irradiated tuna fillets not treated with preservative consisted of Enterobacteriaceae, *Micrococcus* and *Microbacterium-Corynebacterium*. It is therefore obvious that treatment with either CTC or FF changes the microflora in fillets during storage. [From En summ.] **JA**

1 U 116

[Bacteriological testing of drinking water.]

Hungary, Magyar Szabványügyi Hivatal  
*Hungarian Standard MSZ 22901-71* 25pp. (1971) [Hu]

This standard, which replaces MSZ 22901-55 gives the sampling instruments and methods for identification and bacteriological counting of coliforms, streptococci, salmonellae, shigellae and *Pseudomonas aeruginosa*. The different mediums and their preparation are described. A comprehensive chart is given for the permissible coliform count for different types of drinking water. **ES**

2 A 115

Occurrence and properties of bacterial pectate lyases.

Rombouts, F. M.

132pp. ISBN 90 220 0412 0 (1972) [254 ref. En, nl] Thesis, Landbouwhogeschool te Wageningen, The Netherlands

Pectolytic enzyme preparations are used for fruit juice clarification, for treatment of fruit pulps to increase yields of juice and coloured material, for maceration of fruits and vegetables, and for citrus waste utilization. Such enzymes are also involved in spoilage of fruits and vegetables. Very little fundamental work has been carried out on the mode of action of these enzymes and so this study was made. Some 100 pectolytic bacteria belonging





to different genera and species, were obtained by isolation from vegetables and by screening of culture collections. The crude enzyme preparations of 19 of these strains were typed by mutual comparison. Differences in the composition of 5 commercial fungal 'pectinase' preparations were also studied. Purified endo pectate lyase of *Arthrobacter* which was studied in detail, appeared to attack pectate far 'less randomly', than endo pectate lyases of *Bacillus polymyxa* or *Pseudomonas*. The best substrates for pectate lyases were not pectates but 21-44% esterified pectins. A new method for the determination of the number average degree of polymerization of pectic substances was introduced. The literature on pectolytic enzymes is reviewed. JA

## 2 C 41

### Interactions of food starter cultures and food-borne pathogens: *Streptococcus diacetylactis* versus food pathogens.

Daly, C.; Sandine, W. E.; Elliker, P. R.  
*Journal of Milk and Food Technology* 35 (6) 349-357 (1972) [43 ref. En] [Dept. of Microbiol., Oregon St. Univ., Corvallis, 97331, USA]

The ability of *Streptococcus diacetylactis* to inhibit a variety of food spoilage organisms and pathogens in milk and broth cultures was demonstrated. Test organisms included *Pseudomonas* and *Alcaligenes* spp., *Salmonella*, *Staphylococcus aureus*, *Clostridium perfringens* and *Vibrio parahaemolyticus*. In general, approx. 99.0 and 99.9% inhibition was observed in milk and broth, respectively. Possible practical applications of the inhibition were examined. Addition of *Str. diacetylactis* extended the shelf life of artificially contaminated Cottage cheese and prevented proteolysis in milk at 7.5°C by *Pseudomonas fluorescens*. *Staphylococcus aureus* was inhibited >99% in vanilla cream filling, ham sandwich spread, chicken gravy, soya milk, and ground beef stored at 25°C for 24 h. Development of the Gram-negative flora of ground beef was also inhibited >99% after storage at 7.5°C for 7 days. Possible roles of several factors in the mechanism of inhibition by *Str. diacetylactis* are briefly discussed. The effects of pH reached and acids produced by *Str. diacetylactis* on the growth of *Staph. aureus* are described. A greater role of the lactic acid bacteria in fermentations in the food industry is suggested.

AS

## 2 F 87

### Studies on the bacterial flora of vacuum-packaged fresh beef.

Roth, L. A.; Clark, D. S.  
*Canadian Journal of Microbiology* 18 (11) 1761-1766 (1972) [14 ref. En, fr] [Div. of Biol. Sci., Nat. Res. Council of Canada, Ottawa.]

Vacuum-packaging of fresh beef in a gas-impermeable film (vinylidene chloride-vinyl chloride copolymer), as compared to packaging in a gas-permeable film (polyvinyl chloride) reduced the growth rates of most incident bacteria (lower total aerobic and anaerobic counts), favoured the

development of lactobacilli, and markedly increased the odour and colour shelf-life during storage at 5°C. The growth rate of both aerobes and anaerobes on meat packaged in vinylidene chloride (VC) film was about 1/8 of that of meat packaged in the polyvinyl chloride (PVC) film. The flora of VC-packaged samples consisted largely of lactobacilli (50-70%) while that of PVC-packaged samples consisted mostly of pigmented pseudomonads and *Microbacterium thermosphaerum* (collectively 60%). Exposure of VC-packaged samples to air changed the microflora to one resembling that of samples initially packaged in PVC film. VC-packaged meat did not undergo noticeable changes in odour or colour even after 32 days of storage while meat stored in PVC developed off-colour (brown) and off-odour (putrid) in 5 days. The colour shelf-life in PVC film of beef previously stored in VC film was 3 days regardless of how long the meat was stored in the latter film before repackaging. AS

## 2 G 77

### Dehydrated food.

Edlin, R. L. (Kelco Co.)

*United States Patent* 3 694 236 (1972) [En]

Method of producing a dehydrated food product involves mixing a *Xanthomonas* hydrophilic colloid with an aqueous food suspension, with subsequent dehydration of the suspension. IFT

## 2 G 85

[Protein production and metabolic products of some *Pseudomonadaceae* grown on alkanes, particularly tetradecane.] Proteinbildung und Stoffwechselprodukte einiger *Pseudomonadaceae* aus Alkanen, besonders aus Tetradekan.

Schnabl, H.; Rehm, H. J.

*Chemie Mikrobiologie Technologie der Lebensmittel* 1 (Jun.) 126-131 (1972) [48 ref. De, en, fr] [Inst. für Lebensmittelchemie, Tech. Univ., Munich, Federal Republic of Germany]

*Pseudomonas aeruginosa*, *Ps. fluorescens* and *Acetobacter peroxydans* were adapted to a viscous paraffin mixture as sole carbon source, and the amino acid composition of the cellular proteins subsequently studied. The bacterial proteins concentrates contained a lower content of methionine than fish meal (1.1-1.2 vs. 1.7%) but a higher content than brewer's yeast (0.9%) and dried skim-milk (0.8%). Addition of 0.1-0.4% homocysteine to the medium increased the cystine content of the cells to 0.9-12.1% (vs. 0.6% in the controls). Intermediate metabolites from tetradecane were myristic acid, and 2- and 3-tetradecanone. HBr

## 2 H 235

### [Use of ultraviolet rays to eliminate pellicle-forming yeasts.]

Marchenko, A. P.; Marzhanian, A. A.  
*Vinodelie i Vinogradarstvo SSSR* 32 (2) 18-21 (1972) [Ru] [Krasnodarskii Politekhnikeskii Inst., USSR]





The effect of UV rays on pellicle-forming yeasts and acetic acid bacteria was studied under both laboratory and plant conditions. The period of irradiation with a bactericidal lamp BUV-30 (30 W) at  $2537 \times 10^{-1} \text{ nm}$   $30 \mu\text{W}/\text{cm}^2$  was determined, which inhibited the formation of the pellicle following inoculation of microflora into wine. UV radiation had a cumulative effect on microbes. After the pellicle is formed, the UV doses must be several times higher, making the method economically ineffective. Under plant conditions, sufficient doses were 5 h 10 min/day using 2 lamps at a distance of 50 cm from the  $1.3 \text{ m}^2$  surface of the wine. Data are supplied to calculate the irradiation intensity, number of lamps and other indices necessary to prevent pellicle-formation by microbes when using UV lamps. STI

2 M 153

**Changes in the microflora of wild rice during curing by fermentation.**

Goel, M. C.; Marth, E. H.; Stuiber, D. A.; Lund, D. B.; Lindsay, R. C.

*Journal of Milk and Food Technology* 35 (6) 385-391 (1972) [17 ref. En] [Dept. of Food Sci., Univ. of Wisconsin, Madison, 53706, USA]

Freshly harvested wild rice piled 18 in deep was fermented for 34 days at ambient temp. or  $10^\circ\text{C}$ . Some rice at ambient temp. and all at  $10^\circ\text{C}$  was moistened daily (1 gal water/100 lb rice). Samples were taken during fermentation and tested for numbers and kinds of microorganisms. Each time samples were taken some rice of each lot was parched (dried) at approx.  $79^\circ\text{C}$  for 1 h and tested microbiologically. Initial total count (Gram-negative rods predominated) of freshly harvested wild rice was  $1.7\text{--}16.0 \times 10^8$  and increased during fermentation regardless of storage conditions. Moulds ( $1.8\text{--}5.0 \times 10^5/\text{g}$  initially) also increased in number with less growth evident at lower storage temp. Growth of psychrotrophs (mainly *Pseudomonas* spp.) was greatest when wild rice was fermented at  $10^\circ\text{C}$ . Some growth of coliforms was evident but results were erratic. *Escherichia coli*, *Enterobacter aerogenes*, and intermediate forms were isolated. Growth of faecal streptococci during fermentation was minimal; *Streptococcus faecalis* was recovered from some samples and *Str. faecium* from the same or other samples. Predominant moulds were *Mucor* spp., aflatoxinogenic and nontoxigenic *Aspergillus* spp., *Penicillium* spp., and *Rhizopus* sp. *Bacillus* spp. predominated in parched wild rice regardless of how long the rice was allowed to ferment before it was heated. Coliforms, pseudomonads, faecal streptococci, and moulds also were recovered but only from a few samples. Microbial numbers in parched rice generally were  $<1.0\%$  of those in the unheated product. AS

2 R 103

**Experimental studies on the volatile nitrogen compounds produced by *Pseudomonas fragi* in fish extracts.**

Florin, O.

*Acta Veterinaria Scandinavica* 13 (3) 381-402 (1972) [10 ref. En, sv] [Dept. of Food Hygiene, Royal Vet. Coll., Stockholm, Sweden]

The decomposition of nitrogenous compounds of extracts of cooked halibut meat due to the growth at  $4^\circ\text{C}$  and  $17^\circ\text{C}$  of *Pseudomonas fragi*, strain F 111, was followed with determinations of the total volatile nitrogen (TVN) and of trimethylamine (TMA). Fish extract inoculated and stored at  $4^\circ\text{C}$  for 5 days or  $17^\circ\text{C}$  for  $3\frac{1}{2}$  days showed an increase of TVN which was slower at  $4^\circ\text{C}$  than at  $17^\circ\text{C}$ . In an extract prepared from fish meat of poor but acceptable commercial quality, the initial TVN was higher, the increase of TVN was slower, and the TVN max. was lower than the corresponding values for halibut meat of good commercial quality. Correlation between the increase of TVN and pH of the inoculated fish extract was poor indicating that the initial increase of pH was not caused by volatile basic compounds. Exclusion of air after 1 or more days of incubation at  $17^\circ\text{C}$  delayed the onset of the TVN increase but did not prevent it. The final TVN value of a sample layered with paraffin oil 24 h after inoculation was approx. the same as that of an extract layered after 14 days of incubation at  $17^\circ\text{C}$ . In inoculated fish extract samples, sterile-filtered on the day when the extract was layered with paraffin oil, no further increase of TVN was observed. It was confirmed that *Pseudomonas fragi* caused no increase of TMA in the extract of cooked halibut. AS

2 R 104

**Experimental studies on the formation of volatile nitrogen compounds induced by *Pseudomonas fragi* in a synthetic medium with amino acids as source of nitrogen.**

Florin, O.

*Acta Veterinaria Scandinavica* 13 (3) 403-434 (1972) [25 ref. En, sv] [Dept. of Food Hygiene, Royal Vet. Coll., Stockholm, Sweden]

2 S 277

**[The incidence of the spread of bacteria in infectious udder inflammations and its significance for meat hygiene.] Die Häufigkeit des Vorkommens bakterieller Streuung bei ansteckenden Euterentzündungen und deren fleischhygienische Bedeutung.**

Szazados, I.

*Fleischwirtschaft* 52 (9) 1165-1168 (1972) [14 ref. De, en, fr] [Tierärztlicher Kontrolldienst der Fleischwarenind., Pecs, Hungary]

In cases of udder inflammation in cows caused by *Pseudomonas aeruginosa*, *Klebsiella*, *Corynebacterium pyogenes*, *Escherichia coli* and *Staphylococcus aureus* it is often found that due to the spread of bacteria, the organisms are not only found in the udder but also in other organs and muscles. The spread of bacteria was observed in 80% of cases of mastitis caused by *E. coli*, in 64.5% of those caused by *C. pyogenes*, in 61% of those caused by *Ps. aeruginosa*, in 59.4% of those caused by *Klebsiella* and in 50% of those caused by *Staph*





aureus. Of the organs examined the liver was most frequently infected. In cases of inflammation of the udder caused by *E. coli*, *Klebsiella* and *C. pyogenes*, the organs were more often affected than the musculature. In cases of inflammation of the udder caused by *Staph. aureus* and *Ps. aeruginosa*, pathogenic organisms were found in similar amounts in the organs and the musculature. Gram-negative *E. coli* and *Ps. aeruginosa* were found more often in muscle samples than in lymph nodes, whilst Gram-positive *C. pyogenes* and *Staph. aureus* were detected more frequently in lymph nodes. *Klebsiella* occurred with equal frequency in muscle samples and lymph nodes. In view of these findings it is considered essential to carry out a bacteriological examination of the meat of cows suffering from mastitis, whether the illness is chronic or acute. AS

2 T 88

[Acetic acid bacteria participating in wine vinegar production. I. Biological characteristics of *Acetobacter xylinum* and its variants.]

Karova, E. A.

*Nauchni Trudove, Vissh Institut po Khranitelna i Vkusova Promyshlennost* 17 (3) 203-216 (1970, publ. 1972) [33 ref. Bg, ru, en] [Vissh Inst. po Khranitelna i Vkusova Promishlenost, Plovdiv, Bulgaria]

100 strains of acetic acid bacteria were isolated from equipment and vinegar in 8 Bulgarian wine vinegar factories. 44 of them were identified by morphological and cultural characteristics as *Acetobacter xylinum*. Further differentiation by ability to assimilate ammonium salts, formation of keto-compounds and calcium lactate oxidation permitted classification of 26 strains as variant I, and 12 strains as variant II. SKK

2 T 89

[Acetic acid bacteria participating in wine vinegar production. II. Biological characteristics of *Acetobacter aceti*, *A. suboxydans* and *A. lovaniense*.]

Karova, E. A.

*Nauchni Trudove, Vissh Institut po Khranitelna i Vkusova Promyshlennost* 17 (3) 217-229 (1970, publ. 1972) [12 ref. Bg, ru, en]

In continuation of the study of strains from Bulgarian wine vinegar factories (see preceding abstr.), 18 strains were identified as the widely distributed *A. aceti*, 5 as *A. suboxydans* and 2 as *A. lovaniense*. SKK

2 T 90

[Oxidation of D-sorbitol to L-sorbose by acetic acid bacteria.]

Beshkov, M.; Karova, E. A.; Grigorova, D.

*Nauchni Trudove, Vissh Institut po Khranitelna i Vkusova Promyshlennost* 17 (3) 91-96 (1970, publ. 1972) [14 ref. Bg, ru, en]

A total of 22 strains of *Acetobacter xylinum*, *A. aceti* and *A. suboxydans* (see 2 preceding abstr.),

including a strain of *A. suboxydans* from the Leningrad University collection, was screened by culturing on a solid medium containing 1, 2, 5, 7 or 10% sorbitol, and yeast water, and 5 strains capable of growth with 10% sorbitol were tested further. *A. suboxydans* 059 isolated from a wine vinegar fermenter and the Leningrad strain proved the most efficient in sorbitol oxidation, giving 87% conversion to sorbose in incubation on solid medium with 10% sorbitol for 96 h at 30°C and retaining high activity even at 20% sorbitol concn. *A. xylinum* 054 and *A. aceti* 005 were next best with 72 and 40% conversions respectively. SKK

3 A 157

Microbial exopolysaccharides-potential.

Sutherland, I. W.

*Process Biochemistry* 7 (11) 27-30 (1972) [16 ref. En]

Methods for the separation and isolation of slime and capsular polysaccharides are considered. In the latter case it is worth trying to isolate slime producing mutants to save complex capsule separating techniques. The chemical compositions of some polysaccharides are listed and though physical properties have been less well studied the products of commercial importance have similar properties to seaweed alginates and plant exudate gums. Exopolysaccharides isolated from a mucoid type of *Pseudomonas aeruginosa* and strains of *Azotobacter vinelandii* were found to be very similar chemically to alginic acid from seaweed and the advantages of microbiological production over production from seaweed are outlined. Other polysaccharides can be obtained from yeasts *Cryptococcus laurentii* var. *flavescens* and *Hansenula holstii* and from *Zanthomonas campestris* and *Arthrobacter viscosus*. The applications of the gums in the food industry are considered together with possible production costs. WHCA

3 B 25

[Distribution of *Pseudomonas fluorescens* in foods and its enzymatic activities.]

Naoui, Y.; Kokubo, Y.; Nishima, T.; Matsumoto, S. *Annual Report of Tokyo Metropolitan Research Laboratory of Public Health* 21, 41-44 (1969) [20 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, Japan]

175 food samples, comprised of 42 vegetables, 35 salad vegetables and 98 other miscellaneous cooked foods, were investigated for strains of *Pseudomonas fluorescens*. 70 strains of *P. fluorescens* were isolated of which 46 were capable of producing proteolytic or lipolytic enzymes; most of the isolates failed to produce cellulase, amylase, pectinase, chitinase and phosphatase. Incubation at 10°C for 10 and 25°C for 5 days did not qualitatively influence enzymatic activities. All isolates grew well at temp. between 5 and 30°C, but half failed to grow at 37°C. 10% NaCl prevented growth, 25 strains showed tolerance to 7% NaCl, and all strains tolerated 5% NaCl. [From En summ.] AA





3 R 137

**Postmortem changes of sterile fish muscle inoculated with a proteolytic *Pseudomonas* sp.**  
Chung, J. R.; Dollar, A. M.

*Bulletin of the Korean Fisheries Society* 2 (2) 93-104 (1969) [35 ref. En, ko] [Inst. of Sci. Tech., Seoul, Korea]

It was investigated whether muscle proteinases (cathepsin) could be a principal cause of protein degradation during non-frozen storage of a non-fatty fish. Rock fish (*Sevastodes caurinus* and *S. auriculatus*) un-irradiated or  $\gamma$ -irradiated with 0.5-2.0 Mrad were stored at 0°C either in sterile conditions or inoculated with *Pseudomonas* spp. Bacterial growth on the irradiated fish muscle increased less rapidly. The un-irradiated inoculated muscle had the highest pH value after 60 days' storage. The free amino-N did not increase at all in sterile un-irradiated fish muscle. It is concluded that post mortem changes in fish muscle were due to bacterial and not enzymic causes. KoSFoST

3 T 123

**[Acetic acid bacteria and their uses. III. Prevention of clouding of vinegar by diethyl pyrocarbonate.]**  
Yanagida, F.; Suminoe, K.

*Journal of the Society of Brewing, Japan [Nihon Jozo Kyokai Zasshi]* 67 (1) 61-65 (1972) [12 ref. Ja, en] [Dept. of Brewing, Tokyo Univ. of Agric., Setagaya-ku, Japan]

Acetic acid bacteria present in vinegar in the order of  $10^5$  were killed by 25 ppm of diethyl pyrocarbonate (DEPC). The sterilizing effect of DEPC was reduced as the acid concn. of the vinegar decreased. Practically, 100 ppm of DEPC were required for complete sterilization of the clouding bacteria existing in the vinegar in the order of  $10^4$ - $10^6$ . When the sterilized vinegar was re-inoculated with acetic acid bacteria, propagation of the bacteria took place because the sterilizing effect of DEPC could not be maintained for a long time. YN

3 T 149

**Fermentation of polysaccharide gums.**  
Godet, P.

*Process Biochemistry* 8 (1) 33-34 (1973) [En]

Manufacture of XB-23 by fermentation with *Xanthomonas campestris* is described. XB-23 is a light-cream coloured, water-soluble xanthan gum acid salts. It is finding uses in food products, in view of such properties as tolerance to food acid and salts and freeze-thaw and high temp. stability. JN

3 T 182

**[Kinetics of the oxidation of ethanol and acetaldehyde by *Acetobacter mesoxydans*.]**  
Divies, C.

*Annales de Technologie Agricole* 21 (1) 5-16 (1972) [14 ref. Fr, en, es, it] [Sta. de Tech. des Produits Vegetaux, Centre de Recherches INRA, 21034 Dijon Cedex, France]

Kinetics of the oxidation of ethanol and

acetaldehyde by whole cells and particular enzymes of *A. mesoxydans* isolated in a submerged vinegar fermenter, are studied. On the whole cells, oxidation of ethanol, in terms of its concn., shows kinetics with 2 apparent constants,  $K_{m1} = 2.8 \times 10^{-3} M$  and  $K_{m2} = 3.9 \times 10^{-2} M$ . This is again found with the enzymes. Acetic acid is a competitive inhibitor of ethanol oxidation; it intervenes in its non-dissociated form; it also begins to compete with the  $H^+$  ions of the medium. Inhibition by acetic acid is much greater on the enzymes than on the whole cells. Oxidation of acetaldehyde by the enzymes shows 2 apparent constants; acetic acid does not competitively inhibit its oxidation. The measure of the apparent constants for  $O_2$  shows that the acetaldehyde-acetic acid reaction stops before the ethanol-acetaldehyde reaction, when the medium progressively grows poor in  $O_2$ . AS

4 B 39

**New medium for the isolation and enumeration of pseudomonas.**

Solberg, M.; O'Leary, V. S.; Riha, W. E., Jr.  
*Applied Microbiology* 24 (4) 544-550 (1972) [15 ref. En] [Dept. of Food Sci., Rutgers Univ., St. Univ., New Brunswick, New Jersey 08903, USA]

A new medium containing 200 ppb of 2-hydroxy-2',4,4'-trichlorodiphenyloxide (CH3565) and 10 ppm of cetyl-trimethyl-ammonium bromide (Cetrimide) in tryptic soy agar was developed and tested with 19 pure cultures of *Pseudomonas*, 20 microorganisms of other genera, commercially prepared ground beef, and laboratory-prepared inoculated ground beef. The new medium, CETCH agar, was compared with an antibiotic-containing medium. CETCH agar provided greater pseudomonad recoveries, a shorter incubation period prior to plate counting, and greater ease of preparation. AS

4 C 96

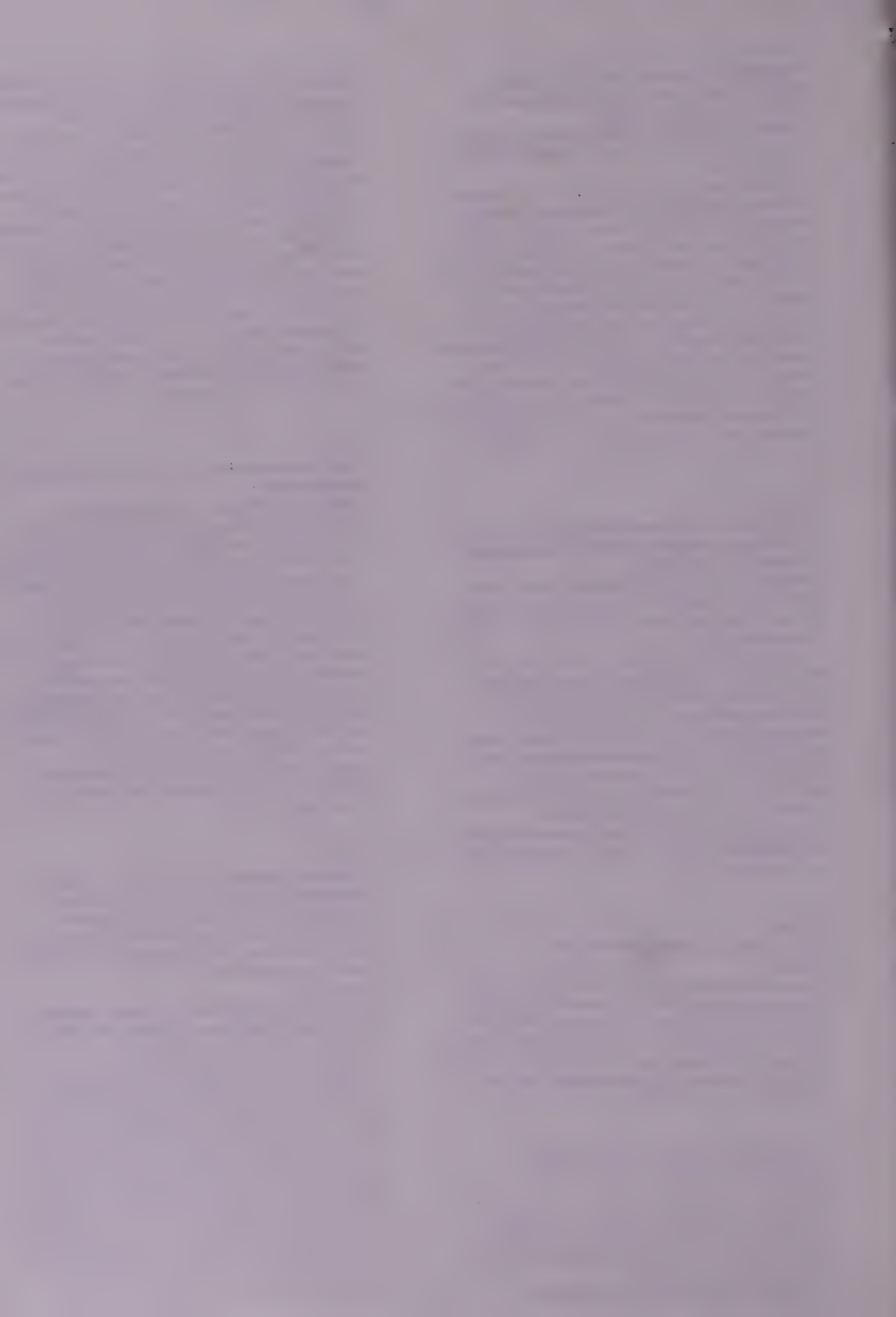
**[*Pseudomonas aeruginosa* - a germ "thriving on civilization". Proof of its spreading in cation exchangers of dishwashers.]** *Pseudomonas aeruginosa* - "ein Zivilisationskeim". Nachweis seiner Vermehrung in Kationenaustauschern von Geschirrspülmaschinen.

Ruschke, R.

*Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, IB* 156 (4/5) 391-398 (1972) [27 ref. De, en]

*Pseudomonas aeruginosa* has become a very problematic germ in hospitals. Its distribution in this area depends on the germ's ability to survive in watery environments low in nutrients. Sometimes *Ps. aeruginosa* is distributed in the kitchen area with contaminated food raw-materials. Another source for growth and distribution of *Ps. aeruginosa* in this area are ion exchangers of dish washers. The inspection of 2 dish washers revealed that *Ps. aeruginosa* originating from the cation exchangers was found in the water, reaching a distribution of up to 64 000/ml. Therefore it is demanded that dish washers should be so designed that the ion





exchangers make it impossible for potential pathogens to multiply and exclude distribution of these germs from the interior of the machines to the exterior. AS

4 J 601

**Introduction of *Pseudomonas aeruginosa* into a hospital via vegetables.**

Kominos, S. D.; Copeland, C. E.; Grosiak, B.; Postic, B.

*Applied Microbiology* 24 (4) 567-570 (1972) [13 ref. En] [Dept. of Pathol. & General Surgery, Mercy Hospital Pittsburg, Pennsylvania 15219, USA]

*Pseudomonas aeruginosa* was isolated from tomatoes, radishes, celery, carrots, endive, cabbage, cucumbers, onions, and lettuce obtained from the kitchen of a general hospital, with tomatoes yielding both highest frequencies of isolation and highest counts. Presence of *P. aeruginosa* on the hands of kitchen personnel and cutting boards and knives which they used suggests acquisition of the organism through contact with these vegetables. It is estimated that a patient consuming an average portion of tomato salad might ingest as many as  $5 \times 10^3$  colony-forming units of *P. aeruginosa*. Pyocine types of *P. aeruginosa* isolated from clinical specimens were frequently identical to those recovered from vegetables, thus implicating tomatoes and other vegetables as an important source and vehicle by which *P. aeruginosa* colonizes the intestinal tract of patients. AS

4 P 446

**[Seasonal changes in psychrotrophic microflora of raw milk.]**

Kozlova, L. A.; Blok, G. G.

*Trudy, Vologodskii Molochnyi Institut* No. 64, 155-164 (1972) [12 ref. Ru]

Counts of psychrotrophic bacteria in raw milk were determined at 3 farms in the Vologda region during Nov. 1969-Oct. 1970; the counts ranged from 80 000 to 6 250 000/ml, being highest in March, April and Aug. and lowest in Nov.; they accounted for 0.6-14% of the total bacterial counts. 65 strains, that grew well at 5-6°C, were isolated and tested for their morphological, cultural and some biochemical characteristics; they were tentatively classified as *Pseudomonas* (predominating), *Proteus* and *Achromobacter* spp. FL

4 Q 60

**Organic acid accumulation in egg products inoculated with known bacterial cultures.**

York, L. R.; Dawson, L. E.

*Poultry Science* 51 (4) 1244-1247 (1972) [9 ref. En] [Dept. of Food Sci. and Human Nutr., Michigan St. Univ., East Lansing, 48823, USA]

Aseptically prepared liquid whole egg samples were inoculated with single species of bacteria and incubated. The control samples, contained small amounts of both acetic and lactic acid, as did all of the inoculated samples. Succinic acid was found in

egg in which *Streptococcus faecalis*, *Salmonella choleraesuis* and *Escherichia coli* were grown, but not in inoculated and incubated egg containing *Pseudomonas fluorescens*, *Achromobacter xerosis* or *Staphylococcus aureus*. *E. coli* inoculated egg contained 16.4 mg of acetic, 13.1 mg lactic and 24.8 mg succinic acid per 100 g egg when the total plate count was  $1.1 \times 10^8$  per ml. However, when the total plate count increased to  $5.4 \times 10^8$  per ml, there was a substantial decrease in the quantity of each acid present. This demonstrated that certain microorganisms in liquid egg may utilize organic acids as well as produce them. AS

4 S 398

**Microbiology of fresh beef in vacuum.**

Brown, W. L.; Hoffman, A.

*Proceedings of the Meat Industry Research Conference* Mar., 45-52 (1972) [6 ref. En] [ABC Res. Corp., Gainesville, Florida, USA]

A study was conducted to collect data on differences in types and numbers of microorganisms present on fresh beef packaged in (i) Cry-O-Vac Saran bags vs. PVC film and (ii) film with low O<sub>2</sub> permeability vs. PVC film. Results of (i) emphasize the importance of packaging material and method of packaging in prolonging the shelf-life of fresh red meat. The bacterial counts of both Saran- and PVC-packaged samples were similar for 6 days storage at 32°F. The microbial numbers of samples packaged in PVC continued to increase thereafter, whereas samples packaged in Saran remained constant during the 15 day test period. The same trend prevailed in samples stored at 38 and 45°F, however microbial numbers of samples packaged in PVC increased at a faster rate. A storage temp. of 45°F was too high for proper storage of fresh red meat in either type of packaging. The types of bacteria isolated from Saran were mainly lactic acid bacteria with some pseudomonads and bacilli present. Pseudomonads predominated in PVC packaged meat and tended to be putrefactive. For (ii) the lower O<sub>2</sub> permeability film gave improved storage stability. AA

4 S 442

**Effects of selected psychrophilic bacteria on the flavor of chicken breast meat.**

Mast, M. G.; Stephens, J. F.

*Poultry Science* 51 (4) 1256-1265 (1972) [19 ref. En] [Dept. of Poultry Sci., Ohio Agric. Res. and Development Center, Columbus, 43210, USA]

To determine the effects of psychrophilic microorganisms on flavor of chicken breast meat, aseptically procured samples were inoculated with an *Alcaligenes* sp., a *Flavobacterium* sp., or *Pseudomonas putrefaciens*, and stored at 3°C for periods of time up to 14 days. Following storage at 3°C, the samples were analyzed for total bacterial numbers. The meat was then heat-treated and the pH of each sample was determined. Broth samples from the meat were presented to a taste panel for flavor evaluation. Both triangle and ranking tests





were utilized. The number of bacteria increased from the initial inoculum of  $10^4$  per gram of chicken breast tissue to  $1.72 \times 10^8$  (*Flavobacterium* sp.),  $1.61 \times 10^{10}$  (*Alcaligenes* sp.), and  $3.40 \times 10^{10}$  per gram (*P. putrefaciens*) after 14 days of storage at  $3^\circ\text{C}$ . Uninoculated chicken breast meat maintained a pH of 6.33 throughout a storage period of 14 days. Samples of chicken breast meat which were inoculated with either the *Alcaligenes* sp. or *P. putrefaciens* increased in pH to 8.9 and 7.95 respectively, after 14 days of storage at  $3^\circ\text{C}$ . The broth extracted from "fresh" chicken meat, i.e., uninoculated and heat-treated immediately after thawing, was judged by taste panelists to be superior in flavor to the broth of all other uninoculated and inoculated meat samples. The broth extract from uninoculated chicken meat was usually judged to be superior in flavor to broth from inoculated meat samples stored for similar periods of time. However, samples inoculated with *P. putrefaciens* and stored for 3 or 7 days were preferred to uninoculated samples stored for corresponding periods of time. AS

#### 4 S 388

[The sensitivity of test strains to different antibiotics as a basis for the detection of antibiotics in muscle and organs with the 'general antibiotic test' (AH-test).] Die Empfindlichkeit von Testkeimen gegenüber verschiedenen Antibiotikareinsubstanzen als Grundlage für den Nachweis von Hemmstoffen in Muskulatur und Organen mit dem allgemeinen Hemmstofftest (AH-Test).

Schaal, M.; Venzel, S.

*Archiv für Lebensmittelhygiene* 23 (9) 189-194 (1972) [19 ref. De, en] [Inst. für Hygiene und Tech. des Fleisches, Tierärztliche Hochschule, Hannover, Federal Republic of Germany]

23 strains of bacteria were tested for their sensitivity towards 8 antibiotics. The organisms used included strains of bacilli, staphylococci, enterobacteria, pseudomonads, and achromobacteria. Antibiotics used were chloramphenicol, bacitracin, dihydrostreptomycin sulphate, procain-penicillin G, tetracycline hydrochloride and flavomycin. Details are given of test medium and working procedures; tests were made at pH 6.0 and 8.0. Data are tabulated showing the min. inhibitory concn. and radius of inhibitory zones for each strain and antibiotic. The most suitable strains for detecting the presence of each individual antibiotic are suggested. As a general method it is concluded that all inhibitory substances likely to be present in meat may be detected by *Bacillus subtilis* strains Bremen, 165, ATCC 6633 and BGA; *B. subtilis* 165 is particularly sensitive towards chloramphenicol and bacitracin. ELC

#### 5 H 693

[Bacteriological investigations into the disinfection by UV irradiation of drinking water used on ships. II.] Bakteriologische Untersuchungen zur Trinkwasserdesinfektion durch UV-Bestrahlung an Bord von Seeschiffen. II. Müller, G.; Goethe, H.; Herrmann, R.

*Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, IB* 156 (4/5) 361-372 (1972) [15 ref. De, en] [Inst. für Wasser-, Boden- und Lufthygiene, Bundesgesundheitsamt, Berlin-Dahlem (West)]

In a continuation of earlier investigations [see FSTA (1971) 3 9H1362], tests were carried out in which mains water was infected with various organisms, and the % kill determined after subjection to UV irradiation; flow rate was  $1 \text{ m}^3/\text{h}$ . Mean % kill over a series of 4 tests was: *Escherichia coli*, 99.85%; *Salmonella paratyphi* B, 99.80%; *Pseudomonas aeruginosa*, 99.51%; *Staphylococcus aureus*, 99.43%; and *Clostridium perfringens*, 15.20%. In every case the disinfecting action was dependent on the initial count. When the same organisms were irradiated in a constant vol. of water by recirculation for 1-6 h, repetition of the dosage had no greater effect than the initial single irradiation except in the case of *Cl. perfringens*, where a mean kill of approx. 84% was achieved. Similar results were obtained when crude effluent was added to the water. In view of the high susceptibility of the drinking water to pollution (e.g. from surface water or effluent) and the fact that a total kill of the organisms tested could not be obtained, UV irradiation is not recommended for disinfection purpose on board ship. HBr

#### 5 L 409

[Starch decomposition by isoamylase and pullulanase and its utilization.]

Yoshida, M.; Masuda, K.; Sakai, S.; Kurimoto, K.; Yokohayashi, Y.; Hirao, M.

*Journal of the Starch Technological Research Society of Japan [Denpunto Gijutsu Kenkyu Kaiho]* No. 40, 21-28 (1971) [23 ref. Ja] [Hayashibara Co., Ltd., Okayama, Japan]

Experiments were carried out to obtain the max. yield of maltose from starch. Commercial production of isomaltose was tried using *Aerobacter aerogenes*, *Pseudomonas* sp., *Lactobacillus plantarum*, *Nocardia corallina*, and *Micrococcus lysodeikticus*. All showed isoamylase activity, i.e. catalysed hydrolysis of  $\alpha$ -1,6-glucosidic linkages in amylopectin. All the enzyme preparations hydrolysed starch almost completely to maltose in conjunction with  $\beta$ -amylase. The enzymes other than that from *Pseudomonas* may be called pullulanase, since they acted upon pullulan. SKa

#### 5 P 559

[Results of a study of milk hygiene carried out over a number of years.] Ergebnisse mehrjähriger lebensmittelhygienischer Milchuntersuchungen. Gerlach, R.; Kielwein, G. *Archiv für Lebensmittelhygiene* 23 (5) 96-99 (1972) [4 ref. De, en] [St. Tierärztliche Untersuchungsamt, Aulendorf, Federal Republic of Germany]

Between 1965 and 1971, a total of 14 736 raw milk and 1009 market milk samples collected in Südwürttemberg-Hohenzollern were examined. During this period, % raw milk samples with cell counts  $<10/\text{field}$  (microscopical method) decreased from 79.7 to 56.6 while % of samples with bacterial





counts <200 000/ml increased from 26.4 to 57 and % having between 200 000 and 1 million bacteria/ml decreased slightly from 25.4 to 23.3. Between 1967 and 1970, % samples with <50 000 coliforms/ml (EMB agar) ranged from a min. of 77.2% in 1968 to a max. of 88.2% in 1969. Raw milk samples with >5000 pseudomonads/ml increased from 14.7 to 35.9% between 1968 and 1970. In the market milk samples, the proportion with bacterial counts of <500 000/ml decreased from 22.6% in 1965/1966 to 10.1% in 1971, while the proportion with 1000 pseudomonads/ml increased from 11% to 36.6%.  
CDP

5 P 589

[Microbiological studies of the efficacy of disinfectants used in dairies.] Mikrobiologische Untersuchungen zur Wertbestimmung eines in der Milchwirtschaft verwendeten Desinfektionsmittels. Sipka, D.

*Archiv für Lebensmittelhygiene* 23 (8) 176-179 (1972) [2 ref. De, en] [Inst. für Milchhygiene und Tech., Vet.-med. Fak., Beograd, Yugoslavia]

A modified amphoteric surface active compound TEGO 51/15 DL (containing lauryl-diethylenetriamino- and lauryl-propylenediaminoacetates, lauryl-diethylenetriamine, lauryl-propylenediamine, benzyl alcohol and ethyl glycol in aqueous solution) gave good results in tests for antibacterial activity in the laboratory and under practical conditions of milk production and processing. In laboratory tests using pieces of batiste dipped in broth cultures, 2 strains each of *Staphylococcus*, *Streptococcus faecalis*, *Escherichia coli* and *Pseudomonas* were all destroyed following 10 min or less immersion in the disinfectant. Under practical conditions, when udders, milking pails and milk cans were disinfected bacteriological quality of the milk improved considerably and methylene blue test showed that percentages of samples having top hygienic quality (reduction time >5½ h) were raised from 9.3 to 30.7. Disinfection of raw-milk containers, cheese vats, tables and raw-milk tankers in a dairy with 1% solution reduced numbers of bacteria by >90% following 20 min contact. MJD

5 R 221

Salmon canning waste water as a microbial growth medium.

Strasline, G. A.; Melville, J. M.  
*Journal of the Fisheries Research Board of Canada* 29 (12) 1769-1771 (1972) [9 ref. En, fr]  
[Fisheries Res. Board of Canada, Vancouver Lab., Vancouver 8, British Columbia]

Investigations were carried out to determine the suitability of salmon-canning waste water as a microbiological growth medium based upon its ability to support the growth of 6 bacterial spp. (*Sorangium* sp., *Pseudomonas putrefaciens*, *Lactobacillus plantarum*, *Aerobacter aerogenes*, *Bacillus* sp., and *Streptococcus faecalis*) both as a complete medium and as a source of available N. On this basis, the waste water compared favourably with 6 commercially available sources of N (trypticase, acidifacase, polypeptone, peptone, phytone and meat extract) used routinely in microbiological growth media. Microbiological

conversion of salmon canning wastes into useful and marketable products is discussed. VJG

5 S 546

Use of carbon dioxide for extending shelf-life of prepackaged beef.

Clark, D. S.; Lentz, C. P.

*Canadian Institute of Food Science and Technology Journal* 5 (4) 175-178 (1972) [17 ref. En, fr]  
[Div. of Biol. Sci., Nat. Res. Council of Canada, Ottawa, Ontario, K1A 0R6]

Storage in carbon dioxide-enriched air increased the odour- and colour shelf-life of prepacked fresh beef by 3 to 10 and 1 to 9 days, respectively, depending on the CO<sub>2</sub> concn. the initial number of bacterial cells on the meat surface and the storage temp. Steaks of lean beef were inoculated with a mixture of psychrotolerant strains of *Pseudomonas* and *Achromobacter*, packaged in cardboard trays, overwrapped with a gas-permeable polyvinyl-chloride film, and incubated at 0-10° C in air containing from 0-20% CO<sub>2</sub>. 15% CO<sub>2</sub> was the preferred concn. since it was nearly as effective as 20% and almost twice as effective as 10%. The smaller the inoculum and the lower the storage temp., the greater was the effectiveness of CO<sub>2</sub>. Off-colour rather than off-odour limited shelf-life in all cases. A short initial exposure of the inoculated meat to 100% CO<sub>2</sub> at 22 or -80° C was without effect on subsequent storage life in air. Carbon dioxide did not affect significantly changes in pH or weight loss due to weep during storage. AS

5 S 570

[Psychrotrophic bacteria contaminating raw pork.] Kokubo, Y.; Umeki, F.; Haruta, M.

*Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi]* 12 (3) 164-169 (1971) [21 ref. Ja, en] [Tokyo Metropolitan Res. Lab. of Public Health, Hyakunin-cho 3-chome, Shinjuku-ku, Tokyo, Japan]

Microbiological studies were made on the muscle tissue of 10 swine obtained at an abattoir. The psychrotrophic bacterial counts which were in the order of 10<sup>5</sup>-10<sup>6</sup>/g of the fresh raw pork increased to the order of 10<sup>8</sup> organisms after 7 days storage at 5° C. The meat stored at 10° C for 3 days contained about 10<sup>9</sup> organisms after 7 days storage at 5° C. The meat stored at 10° C for 3 days contained about 10<sup>9</sup> organisms and had a rotten odour and increased pH. About 70% of the initial isolates from the meat were Gram-negative bacteria such as *Pseudomonas*, *Flavobacterium*, *Achromobacter*. After 7 days storage at 5° C, >90% of the isolates were *Pseudomonas*. Most of the initial isolates grew well at 10-35° C. About 25% of the psychrotrophic isolates had proteolytic activities. TM

7 H 1046

[Antagonism between wine yeasts and acetic acid bacteria.]

Bambalov, G.

*Nauchni Trudove, Viss Institut po Khranitelna i Vkusova Promyshlennost* 18 (1) 117-126 (1971)





[5 ref. Bg, ru, fr] [Vissh Inst. po Khranitelna i Vkusova Promishlenost, Plovdiv, Bulgaria]

25 strains of wine yeast were inoculated at 2% active culture alone or with 550 000 cells of an active *Acetobacter* strain/ml into sterile grape juice or sterile crushed grapes and cultured at 25° or 30°C for 5 days, when yeast and *Acetobacter* counts were carried out and volatile acids, titratable acidity and contents of sugar and alcohol were determined. The results are tabulated. Some yeast strains, P-3, Asenovgrad-11, Novo Selo-17 and Rioja tempranilla in particular, inhibited *Acetobacter* and depressed volatile acid formation. On the contrary, the Pleven-9, Pleven-65, Varna-84, Dimyat and Slavyantsy-25 strains (and some others) did not affect *Acetobacter* activity and in their presence 8-9 g volatile acids were formed/l. (control, in spontaneous fermentation, 8.6 g/l.). SKK

8 T 392

**Nutrition of *acetobacter rancens* S3 and F11 isolated from tanks for vinegar production.**

Mori, H.; Harada, Y.

*Agricultural and Biological Chemistry* 37 (1) 139-144 (1973) [10 ref. En] [Inst. of Sci. & Ind. Res., Osaka Univ., Yamadakami, Suita-Shi, Osaka, Japan]

Two strains (S3 and F11) isolated from static and submerged tanks for vinegar production were identified as *Acetobacter rancens*. Neither strain grew in an  $\text{NH}_4$  defined medium containing ethanol, glucose, glycerol or organic acids as sole C source, but when amino acids from casein hydrolysate ("casamino acids") were added, they grew luxuriantly with lactate, ethanol or glycerol as C source, less well with acetate or glucose. They also grew, forming much acetic acid, in defined ethanol medium with alanine in place of casamino acids. Both strains required lactate or pyruvate in defined glucose medium, but many other organic acids which were effective in defined ethanol medium were ineffective or only slightly effective in glucose medium. AS

8 T 409

**[Acetic acid bacteria and their uses. VII. Vitamin requirements.]**

Yanagida, F.; Yamamoto, Y.; Nishijima, H.; Kaneko, N.; Suminoe, K.

*Journal of the Society of Brewing, Japan [Nihon Jozo Kyokai Zasshi]* 67 (10) 876-880 (1972) [14 ref. Ja, en] [Dept. of Brewing, Tokyo Univ. of Agric., Setagaya-ku, Japan]

See FSTA (1973) 5 3T124 for part IV.

11 H 1841

**[Acetic acid bacteria and their utilization. VIII. Effect of vitamin on growth and acid production of the bacteria.]**

Yanagida, F.; Yamamoto, Y.; Nishijima, H.

*Journal of the Society of Brewing, Japan [Nihon Jozo Kyokai Zasshi]* 68 (1) 56-58 (1973) [1 ref.

Ja, en] [Dept. Brewing, Tokyo Univ. Agric., Setagaya-Ku, Tokyo]

8 strains of type cultures of acetic acid bacteria were cultured in basal media to each of which had been added a single vitamin. Growth and acid production of strains which decompose acetic acid to  $\text{CO}_2$  and  $\text{H}_2\text{O}$  were promoted by addition of pantothenic acid, nicotinic acid and biotin; in strains which do not decompose acetic acid, growth and acid production were promoted always by pantothenic acid, while p-amino benzoic acid, nicotinic acid, or biotin was effective with some strains. [See FSTA 5 (1973) 8T409 for part VII.] YN

11 M 1376

**[Studies on the microorganisms of cereal grain.**

**XIV. Radiosensitivity of a radio-resistant strain of *Pseudomonas radiora* and its recovery from radiation damage.]**

Ito, H.; Iizuka, H.; Okazawa, Y.; Watanabe, H.

*Journal of the Agricultural Chemical Society of Japan [Nihon Noei Kagakkai-shi]* 46 (3) 127-135 (1972) [18 ref. Ja, en] [Japan Atomic Energy Res. Inst., Takasaki Radiation Chem. Res. Establishment]

A radio-resistant bacterium, *Pseudomonas radiora* nov. sp., was isolated from samples of rice. The  $\text{D}_{10}$  value of strain No. 0-1 was 140 krad when irradiated in air, and 60 krad under vigorous aeration. Radio-resistance of cells in air was similar to that in  $\text{N}_2$ . The behaviour of the cells with regard to radio-resistance was similar to that of *Micrococcus radiodurans*. A reduction of radio-resistance by cyanide was observed, which might be due to inhibition of respiration. The cells of this strain could recover at a high rate from the lethal effects of  $\gamma$ -rays by incubation at temp. of 20-40°C. Irradiated cells were able to recover at higher rate in a minimal medium than in a nutritive medium. [From En summ.] [See FSTA (1972) 4 10M1103 for part XIII.] JA

11 R 512

**Identification of the volatile compounds produced in sterile fish muscle (*Sebastes melanops*) by *Pseudomonas fragi*.**

Miller, A., III; Scanlan, R. A.; Lee, J. S.; Libbey, L. M.

*Applied Microbiology* 25 (6) 952-955 (1973) [17 ref. En] [Dept. of Food Sci. and Tech., Oregon St. Univ., Corvallis, 97331, USA]

Volatile compounds produced by *Pseudomonas fragi* strain 18 in sterile fish muscle (*Sebastes melanops*) were identified by combined GLC-MS. Compounds positively identified included dimethyl sulphide, acetaldehyde, ethyl acetate, ethyl alcohol, and dimethyl disulphide. Methyl mercaptan, ethyl butyrate, ethyl hexanoate, and butanone were tentatively identified by relative retention times of the authentic compounds. The fruity odour that developed in fish muscle during incipient spoilage was attributed to a synergistic flavour interaction involving the ethyl esters of acetate, butyrate, and hexanoate. [See also FSTA (1973) 5 9R450.] AS





12 G 593

**Influence of freezing animal tissue in liquid nitrogen on its histological structure and microbiological alterations.**

Piskarev, A. I.; Kaminarskaya, A. K.; Moiseyeva, E. L.; Dibirasulayev, M. A.; Balandina, F. A.

*Proceedings of the International Congress of Refrigeration (13th Washington)* 3, 227-235 (1971, publ. 1973) [2 ref. En, fr] [Sci. Res. Inst. of Refrigerating Ind., Moscow, USSR]

The effect of freezing rate (air-freezing vs. freezing in liquid N) on the histology of meat and fish was investigated; results showed that freezing meat in liquid N results in greater histological changes than air freezing. Considerable changes were observed in fish tissue frozen by both techniques. In a second experiment, the effect of freezing and thawing on the concn. of free amino acids and other ninhydrin-positive substances in meat was investigated. Meat samples were frozen at -18, -50 and -195.5°C, thawed, and stored for  $\leq 12$  days at 0°C. Results showed that free amino acid formation increases with decreasing freezing temp., thawed meat contains more free amino acids than non-frozen meat. In a further experiment, the effects of freezing on the viability of (i) *Pseudomonas fluorescens* and (ii) *Staphylococcus aureus* in fish and milk were investigated. Results showed that (ii) was more freeze-resistant than (i); freezing had no effect on the subsequent generation time, proteolytic activity and toxin formation characteristics of the bacteria. AJDW



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H. BROOKES

ASSISTANT EDITOR





The importance of treating faulty wines before they are distilled is stressed, but if this is not possible the distillate can be treated. For removal of off-odours, good results were obtained, in order of efficiency, with ion exchange resins (combination of anionic and cationic), vegetable charcoal, animal black, mustard flour and mineral oil. Metals present in distillates were reduced to within legal limits by treatment with ion exchange resins, afferine (calcium phytate) or rubeanic acid; Cu and Fe were totally removed by ion exchange or rubeanic acid treatment. Excess  $\text{SO}_2$  was removed by ion exchange treatment, or by treatment with  $\text{H}_2\text{O}_2$  followed by  $\text{CaCO}_3$  to remove the  $\text{H}_2\text{SO}_4$  formed.

## 2

Yanagiya, T.; Mikami, M.; Miura, H.  
*Journal of the Agricultural Chemical Society of Japan [Nihon Nogei Kagakkai-shi]* 47 (4) 259-266  
(1973) [26 ref. Ja. en] [Dept. of Dairy Sci.,  
Obihiro Zootech. Univ., Hokkaido]

Proteolysis of casein and whey proteins by strains of *Pseudomonas* and *Flavobacterium* isolated from bulk-cooled milk was investigated by DEAE-cellulose column chromatography and polyacrylamide gel electrophoresis (PAE). After 7 days of hydrolysis, the chromatographic peaks of  $\beta$ - and  $\alpha_s$ -casein had decreased, whilst the amounts of unadsorbed and early-eluted fractions of casein increased. PAE after 7 days showed slight bands of  $\alpha_s$ - and  $\beta$ -casein, and a clear band in front of the  $\alpha_s$  casein; after 14 days bands of  $\alpha_s$ - and  $\beta$ -casein and faster-moving components had disappeared. PAE patterns and chromatograms of whey protein remained unchanged throughout. [From En summ.] CDP

## 3

Nath. K. R.; Baker, R. C.  
*Applied Microbiology* 25 (3) 442-446 (1973) [18  
ref., En] [Dept. of Poultry Sci., Cornell Univ.,  
Ithaca, New York 14850, USA]

electrophoresis for residual egg albumen revealed extensive proteolysis of albumen inoculated with the organism. It is suggested that along with other bacteriostatic factors present in the egg white, lack of free available water for dissolution of assimilable nutrients is an important factor in controlling the growth of the bacterium in egg albumen. AA

## 4

Miller, A., III; Scanlan, R. A.; Lee, J. S.; Libbey, L. M.

*Applied Microbiology* 26 (1) 18-21 (1973) [14 ref. En] [Dept. of Food Sci. and Tech., Oregon St. Univ., Corvallis, 97331, USA]

Volatile compounds produced by *Pseudomonas putrefaciens*, *Ps. fluorescens*, and an *Achromobacter* sp. in sterile fish muscle (*Sebastes melanops*) were identified by combined GLC and MS. Compounds produced by *Ps. putrefaciens* included methyl mercaptan, dimethyl disulphide, dimethyl trisulphide, 3-methyl-1-butanol and trimethylamine. With the exception of dimethyl trisulphide, the same compounds were produced by an *Achromobacter* sp. Methyl mercaptan and dimethyl disulphide were the major S-containing compounds produced by *Ps. fluorescens*. AS

## 5

**Food poisoning attributed to controversial agents:  
Bacillus cereus, Pseudomonas sp. and faecal  
streptococci. [Review]**  
Foster, E. M.

**Canadian Institute of Food Science and Technology**  
**Journal** 6 (2) 126-130 (1973) [31 ref. En] [Food  
Res. Inst., Univ. of Wisconsin, Madison, USA]

## 6

**Reduction of shelf-life of dairy products by a heat-stable protease from *Pseudomonas fluorescens* P26.**  
White, C. H.; Marshall, R. T.

*Journal of Dairy Science* 56 (7) 849-853 (1973)  
[6 ref. En] [Food Sci. & Nutr. Dept., Univ. of  
Missouri, Columbia 65201, USA]

Milk or milk components inoculated with a heat-stable protease, or with *Ps. fluorescens* P26 which produces this enzyme, were used in the manufacture of various dairy products. Results of the Hull test (for measurable proteolysis) and sensory analyses on the experimental samples were compared with results for controls made without the inocula. No significant differences were observed between experimental and control samples of butter, ice cream mix and milk, all of which were repasteurized at 63°C for 30 min 12 h after inoculation. When protease or *Ps. fluorescens* was added to milk for cheesemaking, and the milk



then held for 12 h at 4°C prior to manufacture, only 16.5% of the variation in flavour scores of Cheddar cheese could be explained by variations in Hull values; bitterness occurred most frequently in cheeses made with *Ps. fluorescens*, and unclean flavour in those made with protease. Cottage cheese made with *Ps. fluorescens* or protease had higher Hull values than had controls ( $P < 0.05$ ); off-flavours were detected in 70 and 50% of cheeses with protease and *Ps. fluorescens* respectively vs. in 21.5% of control cheeses. [See also FSTA (1973) 5 7P1006.] CDP

## 7

**Microbial flora and level of *Vibrio parahaemolyticus* of oysters (*Crassostrea virginica*), water and sediment from Galveston Bay.** Vanderzant, C.; Thompson, C. A., Jr.; Ray, S. M. *Journal of Milk and Food Technology* 36 (9) 447-452 (1973) [33 ref. En] [Dept. of Animal Sci., Texas Agric. Expt. Sta., College Station, 77843, USA]

Aerobic plate counts at 25°C of freshly harvested oysters ranged from  $2.3 \times 10^4$  to  $3.0 \times 10^7$  and those of sediment samples from  $<10^2$  to  $3.0 \times 10^6$ /g. Counts of water samples were nearly always  $>10^2$ /ml. *Vibrio*, *Aeromonas*, and *Moraxella* species predominated in the fresh oysters. *Vibrio parahaemolyticus* was isolated from 39 of 66 oyster samples and from 9 of 30 sediment and water samples. Isolation was most effective with prior enrichment of samples in trypticase soy broth with 7% NaCl and subsequent plating on thiosulphate citrate bile salts sucrose agar. *V. parahaemolyticus* was detected in only 1 of 8 refrigerated retail oyster samples. Aerobic plate counts at 25°C of refrigerated retail oysters were not much different from those of similar lots shucked under aseptic conditions in the laboratory (before shucking and washing in the plants). *Aeromonas* and *Moraxella* species were predominant in oysters at the retail level. AS

## 8

**Growth and enterotoxin B synthesis by *Staphylococcus aureus* S6 in associative growth with *Pseudomonas aeruginosa*.**

Collins-Thompson, D. L.; Aris, B.; Hurst, A. *Canadian Journal of Microbiology* 19 (10) 1197-1201 (1973) [25 ref. En, fr] [Food Res. Lab., Dept. of Nat. Health and Welfare, Ottawa]

The interaction of *Ps. aeruginosa* and *Staph. aureus* S 6 [both isolated from a meat product] was studied in 2 systems. In the 1st system, the 2 organisms were grown together in a single flask. Growth of *Ps. aeruginosa* was unaffected, but growth of *Staph. aureus* was modified. After 24 h, 99.9% of the staphylococci population lost their salt tolerance when plated on media containing 7.5% NaCl and enterotoxin B synthesis by *Staph. aureus* was diminished. In the 2nd growth system, pure cultures of *Ps. aeruginosa* and *Staph. aureus* were

grown in membrane-type spinner flasks. The growth and salt tolerance of *Staph. aureus* were again affected, but to a lesser degree. Cultures of *Staph. aureus* from these experiments recovered their salt tolerance in 6 h when transferred to fresh medium. Nutrient deficiency, lack of O<sub>2</sub>, or pigment production by the pseudomonads did not contribute significantly to loss of salt tolerance or inhibition of enterotoxin B synthesis, but a staphylytic enzyme(s) isolated from *Ps. aeruginosa* was shown to be responsible for the loss of these properties. AS

## 9

**[Thermal resistance of bacterial lipases.]**

Driessen, F. M.; Stadhouders, J.

*Officieel Orgaan, Koninklijke Nederlandse Zuivelbond* 65 (40) 949-952 (1973) [6 ref. Nl]

*Pseudomonas fluorescens* strain 22F was inoculated into milk and incubated at 20°C, bacterial counts and lipase activity being determined at intervals. Some of the lipases produced were inactivated at relatively low temp. (52.5-57.5°C) but others were highly heat resistant, having D-values (decimal reduction times) of, for example, 16 min at 130°C. When 5-day cultures were inoculated (0.15%) into raw milk before sterilization at 143°C for 45 s, the milk became rancid in  $\leq 3$  wk if stored at 20°C, and in  $\leq 1$  wk at higher temp. (30-55°C). When the cultures were added to cheese milk before pasteurization for 10 s at various temp. from 62 to 92°C, the weekly increases in cheese fat acidity (1.51-1.72 m-equiv./mg fat) suggested that many lipases may survive low-temp. pasteurization of cheese milk and lead to excessive lipolysis in cheese. Experiments on the distribution of lipases during cheesemaking showed that most lipase became concentrated in the curd, where it was activated  $>10$ -fold. ADL

## 10

**A numerical taxonomy of *Vibrio* and *Aeromonas* from normal and diseased marine fish.**

Simidu, V.; Kaneko, E.

*Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi]* 39 (6) 689-703 (1973) [25 ref. En] [Inst. of Food Microbiol., Chiba Univ., Izumi-cho, Narashino-shi, Chiba-ken, Japan]

## 11

**Growth of two genera of psychrotrophs on beef adipose tissue.**

Berry, B. W.; Smith, G. C.; Carpenter, Z. I.

*Journal of Food Science* 38 (6) 1074-1075 (1973) [11 ref. En] [Meats & Meat Chem. Section, Dept. of Animal Sci., Texas Agric. Expt. Sta., A&M Univ., College Station, 77843, USA]

Adipose tissue samples from 10 beef carcasses were used to study the effects of carcass location (rib vs. brisket) and





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Bacteria were isolated from raw and pasteurized milks produced throughout SE Queensland. Milk samples were plated initially on penicillin agar or on milk agar and incubated at 30° and 7°C, respectively. On the basis of primary characterization, 167 of the 330 isolates obtained were identified as *Pseudomonas* spp., 157 from raw and 10 from pasteurized milk. The pseudomonads were further characterized in accordance with the taxonomic studies of the genus by Stanier, Palleroni & Doudoroff [Journal of General Microbiology (1966) 43, 159]. Species designations were ascribed to the *Pseudomonas* isolated on the basis of distinctive species characteristics in conjunction with similarity coefficients between each isolate and the ideal species phenotype, as follows: *Ps. fluorescens* (121), *Ps. aeruginosa* (16), *Ps. putida* (12), *Ps. maltophilia* (9), *Ps. pseudoalcaligenes* (5), *Ps. cepacia* (3) and *Ps. alcaligenes* (1). A dendrogram obtained by cluster analysis of the *Pseudomonas* isolates is included. AS





## 16

**Seasonal variations of bacterial flora of fresh oil sardines (*Sardinella longiceps*).**

Karthiayani, T. C.; Iyer, K. M.

*Fishery Technology* 8 (1) 69-79 (1971) [5 ref. En] [Central Inst. of Fisheries Tech., Ernakulam, Cochin-11, India]

A study was carried out monthly for 3 yr (1965-1967) on seasonal variations in bacterial flora of oil sardines. Skin + muscle, gills, and intestines were pour-plated on sea-water agar and incubated at 30 and 37°C for 48 h. Total plate counts were made and total fluorescent bacteria were counted.

Individual colonies were transferred to sea-water peptone and biochemical characteristics studied. At 30°C incubation, peak counts were: skin + muscle July-Oct., gills March-April and Sept.-Nov., intestines Oct.; at 37°C, peak counts were: skin + muscle March and July-Aug., gills March-May and Aug.-Nov., intestines March-April and Oct. High counts during July-Oct. may be attributed to the monsoon. Counts of fluorescent bacteria indicated they were absent from skin + muscle in March-June and from gills in April-June (possibly due to loss of fluorescent character at high summer temp.); they occurred throughout the year on intestines with a peak in July-Oct. Breakdown is given of occurrence of *Pseudomonas*, *Vibrio* and *Achromobacter* in skin + muscle, gills, and intestines during each month of the study. In general, *Pseudomonas* and *Vibrio* predominated in summer and at the end of the monsoon, and *Achromobacter* occurred in large numbers during August. Detailed data are also given of biochemical reactions of isolated colonies. Main conclusions are that season determines total bacterial population, preponderance of different genera and their fluorescent and biochemical characteristics, the monsoon season generally producing higher counts. JA

## 17

**Metabolism of limonoids: isolation and characterization of deoxylimonin hydrolase from *Pseudomonas*.**

Hasegawa, S.; Bennett, R. D.; Maier, V. P.; Border, S. N.

*Abstracts of Papers, American Chemical Society* 167, AGFD 15 (1974) [En] [Fruit and Vegetable Chem. Lab., W. Region, USDA, Pasadena, California 91106, USA]

Bitterness due to limonin in some processed citrus products has become an increasingly important economic problem. A metabolic debittering process could offer a solution to this problem. Considerable progress has been made on metabolism of limonoids in bacteria and citrus fruits. Recently, a new enzyme, deoxylimonin hydrolase, was isolated from *Pseudomonas* 321-18 which catalyses hydrolysis of deoxylimonin to deoxylimononic acid. The enzyme was purified approx. 326-fold over the crude cell-extracts by ammonium sulphate precipitation followed by 3

columns of DEAE cellulose. p-Chloromercuribenzoate and  $\text{HgCl}_2$  were potent inhibitors indicating that the enzyme possesses sulphhydryl groups which are required for activity. The enzyme requires no cofactor and its optimal activity is at pH 8.5. The results of studies on kinetics and substrate specificity are discussed. AS

## 18

**[Is the malachite green broth of Habs & Kirchner suitable as an isolation medium for *Pseudomonas aeruginosa* from water?] Zur Frage der Eignung der Malachitgrün-Bouillon nach Habs und Kirchner als Anreicherungsmedium für *Pseudomonas aeruginosa* aus dem Wasser.**

Schubert, R.; Blum, U.

*Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, IB* 158 (6) 583-587 (1974) [12 ref. De, en]

The addition of malachite green (1:100 000) to the culture medium according to Habs & Kirchner [*Zeitschrift für Hygiene und Infektionskrankheiten* (1943) 124, 557-578] is recommended as constituting a simple and efficient method for the isolation of *Pseudomonas aeruginosa* from water. In the case of 6 *Ps. aeruginosa* strains, the addition of malachite green did not decrease initial growth rate. The other *Pseudomonas* spp. normally occurring in water are to a great extent inhibited in their growth following addition of malachite green. AS

## 19

**[Inhibition of *Pseudomonas putrefaciens* by *Streptococcus diacetylactis* and *Leuconostoc citrovorum*.]**

Oliveira, J. S. de

*Coletanea do Instituto de Tecnologia de Alimentos* 3, 115-128 (1969 1970) [12 ref. Pt, en]

Tests on *Ps. putrefaciens* (isolated mainly from commercial butter showing proteolytic deterioration) showed that this organism was inhibited by citric or acetic acid in 2% solution at  $\leq$ pH 5.5, or by the presence of 7% salt in the nutrient medium. Supernatants from skim-milk cultures of *Str. diacetylactis* or *L. citrovorum* were particularly effective in inhibiting the organism at all pHs below 8.0. Addition of either culture to fresh salted or unsalted butter made from cream that had been inoculated with *Ps. putrefaciens* prevented proteolytic deterioration even after 90 days at 7°C, whereas untreated control samples showed proteolytic deterioration after 7-15 days. At 21°C this effect was found in the controls after only 2-4 days but not in the treated samples even after 15 days. The effect of the *Streptococcus* and *Leuconostoc* cultures was sufficient to prevent



## 20

The relationship between bacteriological and gross pathological findings in udders of culled dairy cows. Ziv, G.; Nachman, I. *Refuah Veterinaria* 30 (1) 1-4, 1-2 (1973) [13 ref. En, He] [Kinton Vet. Inst., Bet Dagan, Israel]

## 21

[Formation of acetic acid by *Acetobacter mesoxydans* in continuous culture, with reference to effects of the initial ethanol concentration.] Davies, C.

*Annales de Technologie Agricole* 22 (2) 91-109 (1973) [17 ref. Fr, en, es, it] [Sta. de Tech. des Produits Vegetaux, Centre de Recherches, INRA, B. V. 1540, 21034 Dijon Dedex, France]

## 22

[Comparative study of *Acetobacter* strains in submerged fermentation.]

Guimaraes Robbs, P.; Assis C. de Barros, F. de *Arquivos da Universidade Federal Rural do Rio de Janeiro* 2 (2) 99-104 (1972) [8 ref. Pt, en] [Dept. de Tecnologia, Inst. de Tecnologia, Univ. Federal Rural, Rio de Janeiro, Brazil]

Vinegar is produced in Brazil by the traditional method, using mixed cultures of *Acetobacter* spp. Laboratory studies were made of several pure *Acetobacter* strains in submerged culture with a view to introduction of the modern industrial submerged culture process. Strains studied were *Acet. rancens*, strains A6 and A7, and *Acet. xylinum* var. *xylinoides* (A5). Mother cultures were grown in a yeast extract-glucose-peptone medium, pH 5.5-6.0, with addition of 3% ethanol, at 30°C for 48 h. Cultures were then inoculated into larger quantities of a sucrose-glucose-yeast extract-peptone medium with addition of 6% ethanol and 2% acetic acid and incubated at 30°C for 2 wk. Determinations were made of cell growth, alcohol consumption and acetic acid production. The A6 strain of *Acet. rancens* was markedly superior, with an oxidation velocity of 0.36% acetic acid/h as against only 0.26% acid/h for the A7 strain. A7 and A5 grown together produced 0.34% acetic acid/h. ELC

## 23

[Occurrence of *A. rancens*, *A. xylinum* and *A. xylinum* var. *xylinoides* in industrial acetifiers of "Carioca-fluminense" area.]

Guimaraes Robbs, P. *Arquivos da Universidade Federal Rural do Rio de Janeiro* 2 (1) 45-50 (1972) [9 ref. Pt, en] [Departamento de Processos Industriais do Ind. de Alimentos, Universidade Federal Rural do Rio de Janeiro, Brazil]

studied. The cultures are classified into 5 groups on the basis of morphological, cultural and biochemical characteristics. Groups I, II, and V corresponded to strains of *Acetobacter rancens*, Group III to *Acetobacter xylinum* var. *xylinoides* and Group IV to *Acetobacter xylinum*. Although the industrial floras were mixed, the Group I *A. rancens* was always predominant (52 to 95% at different plants), whilst Groups III and IV constituted a minor proportion of the flora. It is suggested that the *A. xylinum* spp. are of secondary importance in industrial production. ELC

## 24

A new medium for the isolation and enumeration of pseudomonads.

Solberg, M.; O'Leary, V. S.; Riha, W. E., Jr. *Abstracts of the Annual Meeting of the American Society for Microbiology* 72, 9 (1972) [En] [Rutgers Univ., New Brunswick, New Jersey, USA]

Isolation and enumeration of the important food spoilage microorganisms of the genus *Pseudomonas* are useful in quality evaluation of fresh meat and other foods. Available media were not fully satisfactory. A medium containing 200 parts/billion 2-hydroxy-2',4,4'-trichlor-o-diphenyl oxide (CH3565) and 10 ppm cetyl-trimethyl-ammonium bromide (Cetrimide) in Tryptic Soy Agar was developed and tested using 19 pure cultures of *Pseudomonas*, 20 microorganisms of other genera, commercially prepared ground beef, and laboratory prepared inoculated ground beef. The new medium, CETCH agar, was compared to an antibiotic-containing medium. CETCH agar provided greater pseudomonad recoveries, a shorter incubation period prior to plate counting, and greater ease of preparation. Alkaligenes, *Citrobacter*, and *Enterobacter* species were not selectively inhibited. CETCH agar was an effective selective inhibitor of meat spoilage microorganisms and permitted plate counting of morphologically normal *Pseudomonas* after 48 h incubation at 23 ± 2°C. AS

## 25

Isolation of new limonoate dehydrogenase from *Pseudomonas*.

Hasegawa, S.; Maier, V. P.; King, A. D., Jr. *Journal of Agricultural and Food Chemistry* 22 (3) 523-526 (1974) [16 ref. En] [Fruit and Vegetable Chem. Lab., USDA, Pasadena, California 91106, USA]

A new limonoid-metabolizing bacterium was isolated from soil and designated *Pseudomonas*-sp. 321-18. This organism metabolized limonoate, mainly through deoxylimonin, but cell free extracts contained considerable amounts of limonoate dehydrogenase activity which had properties quite different from the dehydrogenase (limonoate-NAD oxidoreductase) of *Arthrobacter globiformis* previously studied. The new enzyme was characterized as a limonoate-NAD(P)





oxidoreductase. It required Zn ions and sulphhydryl groups for its catalytic action, used both NAD and NADP as cofactors, had a wide pH activity range with the optimal at pH 8.0, and had low affinity for DEAE cellulose. The enzyme has potential industrial use for improving the flavour of citrus fruit juices and products whose quality is impaired by limonin bitterness. AS

## 26

**Recovery of *Pseudomonas aeruginosa* and the *Klebsiella-Enterobacter-Serratia* (KES) group of *Enterobacteriaceae* from vegetables in a hospital kitchen.**

Kominos, S. D.; Copeland, C. E.; Grosiak, B. *Abstracts of the Annual Meeting of the American Society for Microbiology* 73, 113 (1973) [En] [Mercy Hospital, Pittsburgh, Pennsylvania, USA]

Hospital patients carry *Ps. aeruginosa* and *K. pneumoniae* in their gastrointestinal tract more often than people in the community. In an effort to determine sources by which patients acquire these organisms, tomatoes, radishes, celery, cucumbers, endive, lettuce, carrots, and cabbage from the hospital kitchen were examined. With the use of selective media, *K. pneumoniae*, *Ps. aeruginosa*, *Enterobacter* sp. and *S. marcescens* were found. The isolates were identified with biochemical tests. The highest frequencies of recovery of *K. pneumoniae* were from tomatoes, radishes, celery and cucumbers with max. counts of  $10^4$ /g, while *Ps. aeruginosa* was mostly recovered from tomatoes, radishes and celery with max. counts of  $10^3$ /g. Pyocine typing showed a definite similarity between clinical and vegetable isolates of *Ps. aeruginosa*. Biochemical characteristics and response to antibiotics of *K. pneumoniae* and *S. marcescens* showed a similarity between strains from vegetables and clinical specimens. Vegetables and salads brought to patients may constitute a source and vehicle by which patients acquire *Ps. aeruginosa* and bacteria of the KES group. *E. coli* has not been recovered from any of the vegetables examined. AS

## 27

**The influence of incubation temperature on microbial lipase specificity.**

Cooke, B. C.

*New Zealand Journal of Dairy Science and Technology* 8 (3) 126-127 (1973) [6 ref. En] [Dairy Div., Min. of Agric. & Fisheries, Wellington]

*Staphylococcus aureus*, *Micrococcus saphrophiticus*, a *Pseudomonas* sp. and a *Micrococcus* sp., all isolated from rancid butter, were grown at 22, 30 and 35°C on 1% peptone/1% NaCl/5% milk fat agar. After 14 days total fatty acidity was determined by titration of light petroleum-extracted fat against alcoholic 0.02N KOH. Free fatty acids were precipitated with 0.5N KOH from the light petroleum solutions, acidified and extracted with light petroleum before

conversion to methyl esters for GLC. At 22 and 30°C, *Staph. aureus* lipase showed a completely random hydrolysis, whilst the other 3 organisms, like pancreatic lipase, preferentially attacked the 1,3 position of the triglyceride molecule and produced an increase in % C18:1 fatty acid. At 35°C the overall lipase activity was low, but the 2 *Micrococcus* spp. showed a marked, hitherto unexplained, increase in % of C18:1. CDP

## 28

**Microcalorimetry applied to certain species of bacteria growing in sterilized separated milk.** Berridge, N. J.; Cousins, C. M.; Cliffe, A. J. *Journal of Dairy Research* 41 (2) 203-215 (1974) [13 ref. En] [Nat. Inst. for Res. in Dairying, Shinfield, Reading, RG2 9AT, UK]

The heat produced/colony-forming unit (CFU) of growing bacteria was found to depend on the sp. and was greater the younger the culture. With the exception of 2 detn. out of 13 with 6 spp. [*Bacillus cereus*, *Streptococcus cremoris*, *Pseudomonas* sp., *Escherichia coli* I, *Corynebacterium lacticum*, *Klebsiella aerogenes*], the results showed that it should be possible to detect  $<5 \times 10^5$  CFU/ml by the heat produced. A 7th sp., a micrococcus, could be detected at a lower level of CFU presumably because the unit was a clump of several cells. Gross variations which occurred with full-cream milk await investigation. AS

## 29

**[The formation of free fatty acid in whole egg during storage.]**

Germes, A. C.

*Archiv für Lebensmittelhygiene* 24 (12) 273-278 (1973) [31 ref. En, de] [Spelderholt Inst. for Poultry Res., Beekbergen, Netherlands]

Samples of whole egg inoculated with *Pseudomonas fluorescens* and incubated for 24 h (final count  $10^7$ - $10^9$  cells/ml) and non-inoculated samples were spray-dried with or without preliminary pasteurization. The spray-dried product was then stored for  $\geq 18$  months in sealed plastic bags or boxes with perforated lids; at intervals, the total viable count, pH, moisture content and free fatty acid, lactic acid and volatile fatty acid contents were determined. Tables of results are given. Results showed that little if any bacterial growth occurred in the dried samples; acidity increased as a result of lipolysis by extracellular bacterial lipases, which were not inactivated during drying. Inoculated samples had significantly higher acidity values, as did samples stored in perforated boxes at relatively high RH. There was a trend for acidity to higher values in samples stored at higher RH. The acid value of free fatty acids in the dried samples was not significantly different from the acid value of the whole egg. AJDW





## 30

Hydrogen sulfide production by *Pseudomonas putrefaciens* in shrimp experimentally packed in nitrogen.

Lapin, R. M.; Koburger, J. A.

*Applied Microbiology* 27 (4) 666-670 (1974) [20 ref. En] [Food Sci. Dept., Univ. of Florida, Gainesville, 32611, USA]

Shrimp refrigerated in a  $N_2$  atm. develop off-odours not typical of normal spoilage. Investigations of this phenomenon showed that  $H_2S$  developed in the headspace gas, and a large percentage of the microbial population present on the shrimp stored in  $N_2$  was capable of  $H_2S$  production, in contrast to the flora on shrimp stored in air. The predominant  $H_2S$ -producing organism, *Pseudomonas putrefaciens*, was present in low numbers on fresh shrimp but usually reached high numbers by day 8 of  $N_2$  storage. Further studies revealed that cysteine and cystine were the probable substrates in shrimp utilized by this organism for  $H_2S$  production. When shrimp sterilized by irradiation were inoculated with *Ps. putrefaciens* and incubated in an atm. of  $N_2$ ,  $H_2S$  and the characteristic off-odours developed. AS

## 31

Hydrogen sulfide production by *Pseudomonas putrefaciens* isolated from anaerobically stored shrimp.

Lapin, R. M.; Koburger, J. A.

*Abstracts of the Annual Meeting of the American Society for Microbiology* 72, 19 (1972) [En] [Univ. of Florida, Gainesville, 32601, USA]

Fresh shrimp, commercially packed under  $N_2$ , produced off-odours not typical of those observed with aerobic spoilage. In order to characterize this atypical spoilage, shrimp were stored in the laboratory at  $5^\circ C$ . After 17 days, *Pseudomonas putrefaciens* represented 62% of the flora of anaerobically stored shrimp, and  $H_2S$  was readily demonstrated in headspace gas. This organism represented <1% of flora of shrimp stored aerobically as enumerated with peptone iron agar. Experiments to determine some requirements for  $H_2S$  production, were carried out on 6 cultures of *Ps. putrefaciens* isolated from stored shrimp. All isolates produced  $H_2S$  from cysteine, sodium thiosulphate, and shrimp infusion but not from sodium sulphite, potassium sulphate, or methionine. A sodium thiosulphate concn. of 10  $\mu g/ml$  was required before blackening was detected in the medium.  $H_2S$  was produced from thiosulphate in the pH range 6.0-8.5. When the concn. of available S was limited, glucose repressed the formation of sulphide. AS

## 32

[Effects of psychrotrophic microorganisms on the formation of histamine in fish.]

Havelka, B.

*Prumysl Potravin* 25 (1) 24-26 (1974) [24 ref. Sk, ru, de, en] [Ustredny St. Vet. Ustav, Bratislava, Czechoslovakia]

173 bacterial strains were isolated from 49 samples of flesh from tunny imported frozen and defrosted for 1-4 days at  $15-18^\circ C$  or for a longer time at  $5^\circ C$ . The genera represented were: *Pseudomonas*, 102; *Achromobacter*, 34; *Flavobacterium*, 12; *Aeromonas*, 2; *Vibrio*, 2; (family) *Enterobacteriaceae*, 21; 14 strains of the last group belonged to the *Hafnia* genus. 84.4% of the strains were psychrotrophic, growing well at  $4^\circ C$  for 7 days but not at  $42^\circ C$ . Active histidine decarboxylase was detected only in 12 strains, all belonging to the *Hafnia* genus. Max. histidine content of the tunny samples examined was 310 mg/100 g. SKK

## 33

Proteolytic enzymes produced by *Pseudomonas perolens*; their character and action on muscle proteins.

Buckley, D. J.

*Dissertation Abstracts International, B* 33 (11) 5335-5336: Order no. 73-12684 (1973) [En] [Michigan St. Univ., East Lansing, 48823, USA]

Studies on production of proteases by *Pseudomonas perolens* ATCC 10757 are discussed, with special reference to spoilage of cold stored meat. In a preliminary study, the effects of *P. perolens* on protein solubility changes in ground pork at  $10^\circ C$  were studied; the main changes observed were increases in the myofibrillar and non-protein N fractions. Protease production was first noted on the 11th day of incubation, and coincided with an increase in pH. Attempts to purify the enzyme were of limited success. Enzyme production tests on a non-protein medium were then conducted; details are given of the activity and specificity of the resulting enzyme preparation. Treatment of meat with the enzyme resulted in an increase of  $\geq 30\%$  in tenderness, but caused an undesirable potato-like odour. The effects of the enzyme preparation on muscle ultrastructure and protein solubility were studied in a series of experiments; results are discussed in detail. AJDW

## 34

Influence of bacteria on the carbonyl compounds of ground porcine muscle.

Bothast, R. J.; Kelly, R. F.; Graham, P. P.

*Journal of Food Science* 38 (1) 75-78 (1973) [25 ref. En] [Dept. of Food Sci. & Tech., Virginia Polytechnic Inst., Blacksburg, 24061, USA]

Quantitative data were obtained for total carbonyls, total monocarbonyls, methyl ketones, saturated aldehydes, 2-enals and 2,4-dienals from fresh, reduced surface flora and inoculated muscle samples incubated at optimal growth temp. of the respective bacteria. Individual monocarbonyl



compounds were identified by TLC and GLC. *Micrococcus cryophilus*, *Pseudomonas fluorescens* and *Staphylococcus aureus* decrease total carbonyls by 57, 18 and 43%, respectively, and total monocarbonyls by 53, 20 and 33%, respectively. *Pediococcus cerevisiae* increased the total carbonyl and total monocarbonyl content by 70 and 71%. Conc'n. of carbonyls in control samples were directly related to temp. of incubation. Methyl ketones, saturated aldehydes, 2-enals and 2,4-dienals were decreased by *M. cryophilus*, *Ps. fluorescens* and *Staph. aureus* but each monocarbonyl class was increased by *P. cerevisiae*. IFT

### 35

[Phosphate starch for mayonnaise production.] Koptelova, E. K.; Dvinina, A. S.; Zhushman, A. I.; Dudina, E. A.; Chekmareva, I. B. *Sakharnaya Promyshlennost'* 48 (1) 54-58 (1974) [Ru] [VNIIC, USSR]

Consideration is given to the production of phosphate starch which is used as a stabilizer in mayonnaise production. Analysis of phosphate starch manufactured under normal conditions confirmed the virtue of the starch for the given purpose. The effect of dextrinization time and temp. on the fundamental phosphate starch properties was assessed. The production process was devised. Phosphate starch was used in commercial low concentration mayonnaise production. STI

### 36

[Possibility of submerged culture of acetic acid bacteria. II. Effect of size of inoculum and temperature.]

Karova, E.

*Nauchni Trudove, Vissht Institut po Khranitelna i Vkusova Promyshlennost'* 19 (3) 325-331 (1972) [8 ref. Bg, ru, en]

Pure cultures of *Acetobacter aceti* 050, and *A. xylinum* 049 were grown in submerged culture in wine of 6% alcohol content, using 48-h inocula at conc'n. of 10-30% and growth temp. up to 40°C. Best results were obtained with a 15% inoculum and growth temp. of 22-28°C. [See preceding abstr. for part I.] HBr

### 37

[Chemical sterilization of fermentation media with sorbic acid.] Chemische Sterilisation des Fermentationsmediums mit Sorbinsäure.

Bomar, M. T.

*Lebensmittel-Wissenschaft Technologie* 7 (1) 53-56 (1974) [17 ref. De, en]

[Bundesforschungsanstalt für Lebensmitteluntersuchung Inst. für Physik und Biol., D-75 Karlsruhe, Federal Republic of Germany]

The application of sorbic acid as a potential

sterilizing agent was investigated on several microorganisms. With regard to one yeast strain (*Saccharomyces cerevisiae*) a sterilization effect was achieved by applying 0.1% sorbic acid at pH 4.0 and 45°C for 7 h. Since *Bacillus subtilis* and *B. stearothermophilus* as well as their spores were found to be very sensitive to low pH values, sorbic acid could be omitted. An exposure time of 7 h at pH 4.0-5.0 proved to be sufficient for achieving a sterilization effect. Cells of *Pseudomonas* sp. were readily killed when they were exposed for 7 h at 45°C to a 0.1% sorbic acid solution adjusted to pH 4.0. AS

### 38

Production of ethyl esters by some lactic acid and psychrotrophic bacteria.

Hosono, A.; Elliott, J. A.; McGugan, W. A.

*Journal of Dairy Science* 57 (5) 535-539 (1974) [11 ref. En] [Food Res. Inst., Canada Dept. of Agric., Ottawa]

The production of esterases by 5 strains of lactic acid bacteria (*Streptococcus diacetilactis* ATCC 15346, *Str. lactis* ML3, *Str. cremoris* TR, *Lactobacillus* No. 81, and *L. casei* L323) and 2 strains of psychrotrophic bacteria belonging to the genus *Pseudomonas* (strains 50 and 53) were studied. All strains contained esterase capable of esterification of butyric and caproic acids with ethanol. Production of these was very weak in strains TR and L323. In lactic acid bacteria, production of ethyl butyrate was higher than ethyl hexanoate. The psychrotrophic bacteria produced much higher amounts of the enzymes. Production of enzyme by the lactic acid bacteria was markedly suppressed upon incubation under N<sub>2</sub> whereas strains 50 and 53 showed increased production under N<sub>2</sub>. Production of enzyme by all the strains was markedly affected by pH of the medium [optimum initial pH was 6 or 7 for lactic acid bacteria and 8 for the psychrotrophs]. AS

### 39

Effect of antibiotics on the bacterial flora of raw milk.

Ostwal, K. P.; Kulkarni, N. B.

*Indian Journal of Dairy Science* 26 (3) 205-207 (1973) [13 ref. En] [Coll. of Agric., Poona]

The cup assay method was used to determine the antibiotics sensitivity of 17 bacterial strains isolated from raw milk. Streptomycin, chloromycetin and oxytetracycline (each at 50 ppm) inhibited growth of all the isolates (5 *Micrococcus* spp., 3 *Pseudomonas* spp., 3 *Alcaligenes* spp., 5 *Bacillus* spp., 1 *Agrobacterium* and 1 *Enterobacter*). 50 ppm penicillin inhibited the Gram-positive species and the Gram-negative *Pseudomonas* spp. Chloromycetin and oxytetracycline inhibited the growth of other 2 antibiotic-resistant strains. Chloromycetin or oxytetracycline was added to milk after 10 min





treatment at 90°C for 15 min, it prevented spoilage of the milk for >28 days (vs. 4-7 days in controls given heat treatment only). CDP

## 40

[Study of microbial content of non-carbonated natural mineral water and thoughts on public health evaluation of such water. I.] Untersuchungen über den Keimgehalt von unkarbonisierten, natürlichem Mineralwasser und Überlegungen zum bakteriologisch-hygienischen Beurteilen von unkarbonisiertem Mineralwasser. I. Schmidt-Lorenz, W.

*Chemie Mikrobiologie Technologie der Lebensmittel* 3 (4) 97-107 (1974) [De, en, fr] [Lehrstuhl für Lebensmittel-Mikrobiol., Eidgenössische Tech. Hochschule, Zürich, Switzerland]

A total of 25 1.5-l. PVC bottles of 'Contrex' mineral water bottled in France was examined after commercial storage for 1, 4 or 6 wk. Using different methods with 250-ml samples, no coliforms, *Escherichia coli*, Enterobacteriaceae, enterococci, mesophilic clostridia or *Pseudomonas aeruginosa* were detected in any of the samples; and, after incubation at 37°C, no mesophilic bacteria were detected in 1-ml. or *Pseudomonas* spp. or *Pseudomonas aeruginosa* in 0.1-ml samples. It is considered that the standard method for enumeration of microorganisms in water using 48-h incubation on gelatin plates is highly inaccurate and unreliable; that multiplication of psychrophilic flavobacteria in filtered but not otherwise treated mineral water is, as in normal drinking water, unavoidable and completely harmless; that rejection of mineral water when incubation at 20-22°C causes an increase in bacterial count is unjustified; and that application of a bacteriological max. standard of 100 microorganisms/ml is equally unjustified. SKK

## 41

[Comparison of suitability of different media for isolation of *Pseudomonas aeruginosa* from foods.] Burzynska, H.; Maciejaska, K. *Roczniki Panstwowego Zakladu Higieny* 25 (2) 229-235 (1974) [18 ref. Pl, ru, en] [Panstwowy Zaklad Higieny, Warsaw, Poland]

MacConkey agar, S.S. [Salmonella/Shigella] agar, King A and King B media [see Thom et al., *Journal of Applied Bacteriology* (1971) 34, 611] with or without nitrofurantoin, were compared as media for isolation of *Ps. aeruginosa* naturally present in or added to a total of 69 samples of whole and skimmed milk, cream with different fat %, perishable sausages, Tartar steak and vegetable salad. 11 strains of *Ps. aeruginosa*, 2 of *Ps. fluorescens*, 2 of *Aeromonas*, 4 of *Escherichia coli*, and 1 each of *Campylobacter*, *frankii*, *Salmonella typhimurium*, *Salmonella enteritidis* and *Sh. flexneri* were used in these tests. King B medium with nitrofurantoin was found best of those tested; *Ps. aeruginosa* was isolated from 100% of the samples, growth of Enterobacteriaceae was inhibited. SKK

## 42

[Kinetics of fermentation processes. III. Computer modelling of batch cultivation of microorganisms.] Janzso, B.; Bacs-Töröcskei, E.; Reichart, O. *Sörípar* 20 (2) 63-68 (1973) [14 ref. Hu, de] [Budapesti Muszake Egyetem, Budapest, Hungary]

On the basis of the equations developed by Kono & Asai [see *Journal of Fermentation Technology* [Hakko Kagaku Zasshi] (1968) 46, 391 and (1971) 49, 128], computer programs in Algol 60 language for ODR-1204 type computers are given for various types of proliferation curve for *Acetobacter suboxydans* ATCC 621, *Rhodotorula rubra* and *Escherichia coli*. The programs also check the accuracy of the kinetic constants, which are essential for detn. of the biomass produced by the relevant organisms. [See *FSTA* (1974) 6 11E525 for part I & II.] IF

## 43

The role of *Bacillus cereus* in the sweet-curdling defect of fluid milk. Atmaram, K.

*Dissertation Abstracts International, B* 34 (3) 1141: Order no. 73-19994 (1973) [En] [Univ. of Tennessee, Knoxville, 37916, USA]

28% of commercially pasteurized milk samples from various plants throughout Tennessee exhibited sweet-curdling after ≤10 days of refrigerated storage. *B. cereus* isolates obtained from the curdled samples differed from the type culture strain only in their ability to cause sweet curdling of skim-milk at refrigeration temp.; individual strains showed marked differences in their response to heat activation and to the initial excessive growth of *Pseudomonas* spp. in raw skim-milk. Spores of 3 isolates examined showed greater activity after heating for 15 s at 80°C than at 71.5°C, and sweet curd formation was associated with counts of 40 million to >60 million. Excessive growth of *Pseudomonas* spp. in raw skim-milk prior to processing stimulated growth of psychrotrophic *B. cereus*, particularly when the spores were activated at 80°C for 15 s. CDP

## 44

Proteolytic activity of *Pseudomonas perolens* and effects on porcine muscle.

Buckley, D. J.; Gann, G. L.; Price, J. F.; Spink, G. C.

*Journal of Food Science* 39 (4) 825-828 (1974) [33 ref. En] [Michigan St. Univ., East Lansing, 48824, USA]

Changes in solubility of primary muscle proteins attributable to presence and growth of *Ps. perolens* were increases in extractability of myofibrillar and nonprotein N components at the expense of sarcoplasmic and stroma proteins. Initiation of production of high levels of proteolytic enzyme by *Ps. perolens* in inoculated pork occurred concurrently with a rapid rise in pH and the peak of





the bacterial growth curve. Incubation of porcine muscle at 3°C with or without bacterial cells resulted in minor ultrastructural changes. The purified proteolytic enzyme extract produced by *Ps. perolens* appeared to cause removal of the Z line and M line after as little as 4 days incubation. Fragmentation of myofibrils and disintegration of actin filaments was evident after 8 days. Those samples containing bacterial cells exhibited varying degrees of ultrastructural damage after 8 days incubation. Localized disruption of myofibrils was observed and may have been due to localized growth or enzyme elaboration of bacterial cells.

IFT



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VOLUME 7

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H. BROOKES

ASSISTANT EDITOR





1

[Description of a new species of *Pseudomonas*, *P. mexicana*, and determination of *Escherichia coli* var. *neapolitana* isolated from pozol.]

Fuentes, I.; Herrera, T.; Ulloa, M.

*Revista Latinoamericana de Microbiologia* 16 (2) 99-103 (1974) [12 ref. Es, en] [Dept. de Botanica, Inst. de Biol., Univ. Nacional Autonoma de Mexico, 20, Mexico]

A new *Pseudomonas* sp., *Ps. mexicana* Fuentes, Herrera & Ulloa, isolated from pozol, a fermented maize dough used as a staple food in southeastern Mexico, is described. *Escherichia coli* var. *neapolitana* was also isolated from the same food.

AS

2

[Study of methods of testing disinfectants. II. Carriers of test organisms and their treatment.]

Bisping, W.; Kirpal, G.

*Archiv für Lebensmittelhygiene* 25 (4) 84-88 (1974) [3 ref. De, en] [Inst. für Mikrobiol. & Tierseuchen, Tierärztliche Hochschule, Hanover, Federal Republic of Germany]

Pieces of wood  $2 \times 0.8 \times 0.4$  cm, Al plates  $2 \times 1 \times 0.1$  cm and rough-surface ceramic pieces  $1.2 \times 1.2 \times 0.4$  cm were contaminated with 16-h broth cultures of *Staphylococcus aureus* SG 511 or *Pseudomonas aeruginosa*, both containing  $10^8$  microorganisms/ml, and the objects were used as models in disinfection experiments with Tego 51 and formaldehyde, both at 4, 2, 1 or 0.5% concn. The end-point method of the German Society for Hygiene and Microbiology [see Deutsche Gesellschaft für Hygiene und Mikrobiologie (1969) Richtlinien zur Prüfung chemischer Desinfektionsmittel, Edition 2. Stuttgart, Federal Republic of Germany; Verlag Fischer], involving determination of disinfectant concn. at which no viable bacteria can be detected on test objects; the contamination reduction method of Schmidhofer et al. [FSTA (1972) 4 10C245]; and an end-point method based on the Schmidhofer technique and involving incubation of rinsings were compared in these experiments. It is concluded from results tabulated in detail that wood and Al, but not ceramic objects are suitable as model test organism carriers; and that the first method is to be preferred to the other two from the viewpoints of economy of time and materials and precision of findings. [See FSTA (1974) 6 1C10 for part I.] SKK

3

The penetration of selected *Pseudomonas* species into intact bovine muscle.

Thuong, L. V.

*Dissertation Abstracts International*, B 35 (2) 881: Order No. 74-17686 (1974) [En] [Cornell Univ., Ithaca, New York, 14850, New York, USA]

Pure cultures of *Pseudomonas fluorescens* and *P. fragi* were used for inoculation of the surface of bovine adductor or semimembranosus muscle, cut

parallel to or perpendicular to the muscle fibres. The inoculated muscle samples were then stored at 2°C for 9 days. Surface growth of the bacteria and their penetration into the meat were evaluated, together with selected characteristics (pH, total moisture, water-holding capacity, extract release vol., non-protein N and sarcoplasmic, myofibrillar, and stroma protein concn.). Bacterial penetration was confined to approx. the first 1.2 cm of the meat; cutting perpendicular to the muscle fibres favoured penetration. Inoculated samples had a higher NPN content than non-inoculated meat. The pH of inoculated samples increased and the extract release vol. decreased with increasing storage time; no corresponding changes in the non-inoculated samples were observed. The sarcoplasmic protein concn. in both inoculated and non-inoculated samples decreased. No significant changes in the other characteristics studies were observed.

AJDW

4

[Influence of incubation temperature on the growth of psychrotrophic bacteria isolated from frozen pork.]

Kokubo, Y.

*Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi]* 15 (3) 188-194 (1974) [22 ref. Ja, en] [Tokyo Metropolitan Res. Lab., Hyakunincho 3-chome, Shinjuku-ku, Japan]

Regardless of the genera of the organisms which were isolated from the frozen pork, the min. temp. for the growth of the isolates were below 0°C and the optimal temp. were 25 to 30°C. Among these isolates, fluorescent and non-fluorescent *Pseudomonas* isolates showed max. growth temp. of 35 and 40°C, respectively. The growth temp. characteristics of these strains isolated from the frozen pork were compared with those of the reference strains of stock cultures. TM

5

[Isolation and identification of acetic acid bacteria.]

Turtura, G. C.; Casalicchio, F.; Biavati, B.

*Annali di Microbiologia ed Enzimologia* 23 (4/5) 157-164 (1973) [42 ref. It, en] [Istituto di Microbiol. Agraria, Univ., Bologna, Italy]

More than one thousand strains of acetic acid bacteria were isolated from vinegars and from soured, pressed grapes. On account of their ability to oxidize ethanol, all the isolates were assigned to the genus *Acetobacter* and ascribed to the following species: *A. rancens* (32%), *A. mesoxydans* (23%), *A. ascendens* (12%), *A. aceti* (11%), *A. xylinum* (10%), *A. paradoxum* (7%), and *A. lovaniense* (5%). AS

6

Structure and Activity of  
Juffs, H. S.



*Australian Journal of Dairy Technology* 29 (2) 74-78 (1974) [27 ref. En] [Otto Madsen Dairy Res. Lab., Hamilton, Queensland, Australia]

Addition of milk-clotting proteases obtained from *Ps. aeruginosa* or *Ps. fluorescens* to cheese milk in quantities equivalent to 2-17% of added rennet resulted in the formation of soft-bodied, slow-draining curd, although the final moisture content of the cheese was similar to that of controls. A higher incidence of flavour defects was found in mature cheese containing added protease after assessment by conventional grading techniques, but this was not made apparent by taste panel evaluation. BAL

## 7

A study of factors affecting the survival of dried bacteria during storage [freeze-dried cells of *Pseudomonas fluorescens* and *Salmonella newport*]. Marshall, B. J.; Coote, G. G.; Scott, W. J. *Technical Paper, Division of Food Research, CSIRO* No. 39, 29pp. (1974) [13 ref. En] [Div. of Food Res., CSIRO Food Res. Lab., PO Box 52, North Ryde, NSW 2113, Australia]

## 8

Agricultural plants and soil as a reservoir for *Pseudomonas aeruginosa*.

Green, S. K.; Schroth, M. N.; Cho, J. J.; Kominos, S. D.; Vitanza-Jack, V. B.

*Applied Microbiology* 28 (6) 987-991 (1975) [18 ref. En] [Dept. of Plant Pathol., Univ. of California, Berkeley, California 94720, USA]

The occurrence of *Pseudomonas aeruginosa* in soil and in or on food plants (tomatoes, onions, lettuce, celery, cauliflower, potatoes, cabbage, broccoli, spinach, garlic, corn) in California was studied; *Ps. aeruginosa* was detected in 24% of soil samples and 0.13% of the vegetable samples (tomatoes and lettuce). The distribution of pyocin types resembled that of clinical strains. *Ps. aeruginosa* grew well in lettuce or pinto bean leaf tissue. The results are discussed with reference to the possibility of contamination of vegetables with *Ps. aeruginosa* during harvesting, handling and transport, and the significance of fresh vegetables as a source of *Ps. aeruginosa* infection of humans. AJDW

## 9

The role of *Bacillus cereus* in sweet curdling of fluid milk.

Overcast, W. W.; Atmaram, K.

*Journal of Milk and Food Technology* 37 (5) 233-236 (1974) [12 ref. En] [Dept. of Food Tech. and Sci., Tennessee Agric. Exp. Sta., Knoxville, Tennessee 37901, USA]

28% of 54 commercially pasteurized milk samples, obtained over 1 yr from various plants in Tennessee, developed sweet curdling due to *B. cereus* within 8-10 days at 5-7°C. Three isolates, which differed from the Type culture *B. cereus* 14579 only in their ability to produce sweet

curdling in skim-milk at refrigeration temp., exhibited marked differences in their response to heat activation. However, all 3 strains exhibited greater activity after activation for 15 s at 80°C than at 71.5°C. Initial excessive growth of pseudomonads in the raw milk had a stimulatory effect on 2 of the 3 *B. cereus* strains, especially in combination with activation at 80°C for 15 s; the effect was significant ( $P < 0.01$ ) for 1 strain in skim-milk which had been incubated with *Pseudomonas fluorescens* prior to sterilization and inoculation with heat-activated (80°C for 15 s) spores. CDP

## 10

Influence of carbon dioxide upon the metabolism of *Pseudomonas aeruginosa*.

King, A. D., Jr.; Nagel, C. W.

*Journal of Food Science* 40 (2) 362-366 (1975) [38 ref. En] [US Fruit & Vegetable Products Lab., Puyallup, Washington, USA]

## 11

[Preliminary detection of *Pseudomonas aeruginosa* incidence in foods.]

Bruzynska, H.; Meciejska, K.; Borowiak, M.; Czarnowska, W.; Dziurawicz, Z.; Gorecka, E.; Grubner, M.; Juchnowicz, I.; Kasza, I.; Koc, T.; Lewicka, J.; Maciaszek, A.; Smykal, B.; Wilczynska-Stelmach, W.

*Roczniki Panstwowego Zakladu Higieny* 25 (6) 641-647 (1974) [21 ref. Pl, ru, en] [Panstwowy Zaklad Higieny, Warsaw, Poland]

A total of 2065 food samples (1538 taken in the course of public health control, 478 samples of hospital meals and 49 other samples) was examined. *Ps. aeruginosa* was detected in 13 of 293 samples of milk; 7 of 260 samples of sour cream; in none of 205 samples of twarog, 29 of milk drinks or 12 of butter; and in 2 of 5 other milk products. For meat products, the incidences were: 13 of 227 samples of sausage, none of 103 samples of pickled or smoked meat products, and 3 of 8 samples of ground meat. For delicatessen, the incidences were: salads 8 of 126; meat jellies and pate, 5 of 97; steak tartare, 3 of 89; fish products, 0 of 65; and other, 0 of 19. For hospital meals, the incidences were: infant formulae, 4 of 204; main dishes, 2 of 151; milk dishes, 1 of 84; human milk, 2 of 5; and other, 3 of 34. Information on contamination levels of the foods studies is presented. 56% of all contaminated samples contained  $\leq 100$  *Ps. aeruginosa*/g, 35% contained  $10^2$ - $10^4$ /g and 6% contained  $10^4$ - $10^5$ /g. 84% of the 44 strains isolated showed proteolytic properties and 59% haemolysed horse and sheep blood. SKK





## 12

[Study of submerged cultivation of acetic fermentation bacteria.]

Karova, E.

*Lozarstvo i Vinarstvo* 22 (6) 36-40 (1973) [Bg]

Cultivation of *Acetobacter aceti* and *Acetobacter xylinum* in wine produced considerable amounts of acetic acid when the initial content of alcohol was 6-9%; with 10, 11 or 12% alcohol the lag-phase was extended, acid formation was reduced and no bacterial proliferation occurred in some samples. By increasing the alcohol content from 6% to 9% the transformation of ethyl alcohol to acetic acid was reduced from 97% to 87%. If the initial concn. of acetic acid in wine increases from 1% to 3%, the propagation of *Acet. aceti* 051 and *Acet. xylinum* 024 is retarded, together with the formation of acetic acid. STI

## 13

[Microbiological control of wine.] [Lecture]

Spagnoli, F.

*Rivista di Viticoltura e di Enologia* 27 (10) 420-430 (1974) [27 ref. It, en]

This lecture, presented at a technical seminar of the Italian Wine Technologists Association, includes instructions on the Gram-staining procedure as well as composition of several culture media, for isolation of acetic acid bacteria in particular. SKK

## 14

Bioengineering a dairy activated sludge microflora - an approach.

Chambers, J. V.

*Italian Cheese Journal* 4 (2) 1, 3-6, 8 (1975) [En] [Purdue Univ., West Lafayette, Indiana, USA]

After discussing the principles and importance of activated sludge systems, and the concept of bioengineering a sludge microflora into a dairy waste treatment operation, the author reports on an investigation of an activated sludge system which had been in operation for >6 yr at a dairy plant with a daily milk processing vol. of up to 1.5 million lb. Operation had been inconsistent, with the main problems being excessive foaming, 'bulking', and loss of suspended solids in the final effluent. An experimental programme was initiated in which the system was seeded on a batch basis by introduction of 'acclimatized' *Pseudomonas* cultures into the system 3x/wk for 2 wk to establish this major constituent of the sludge microflora. The efficiency of BOD removal was thereby increased from 80-90 to 98%, and that of COD removal from 70-85 to 93%; the amount of sludge solids in the system increased by 30%, and there was an improvement in sludge settlement (shown by a decreased sludge vol.). CDP

## 15

[Culture of microorganisms.]

Shell Internationale Research Maatschappij BV  
Netherlands Patent Application 7 404 875 (1974) [Nl]

Treatment of a pink-pigmented *Pseudomonas* sp. (preferably *P. extorquens*) with a chemical mutagen (preferably ethyl methyl sulphonate) produces a non-pink mutant which may be used for aerobic fermentation (preferably at 38-45°C and pH 6.4-7.4) of a liquid medium containing methanol as the only C source. The resulting edible high-protein product may then be spray-dried or freeze-dried after flocculation, sedimentation and/or precipitation, and centrifugation and/or filtration. W&Co

## 16

['Akameshi', coloration of steamed rice which appears during the sake making process. III. Classification of the 'Akameshi' bacteria.]

Matusuno, M.

*Journal of the Society of Brewing, Japan [Nihon Jozo Kyokai Zasshi]* 69 (6) 396-398 (1974) [17 ref. Ja, en] [Food Res. Inst., Min. of Agric. & Forest., Fukagawa, Tokyo, Japan]

White rice sometimes becomes red ('Akameshi') after steaming when contaminated with some bacteria. So-called 'Akameshi' bacteria were isolated from brown rice, rim of steeping vessels, and 'Akameshi' and identified. They belonged to *Pseudomonas fluorescens* biotype A. YN

## 17

Metabolism of limonoids, isolation and characterization of deoxylimonin hydrolase from *Pseudomonas*.

Hasegawa, S.; Maier, V. P.; Border, S. N.; Bennett, R. D.

*Journal of Agricultural and Food Chemistry* 22 (6) 1093-1096 (1974) [16 ref. En] [Fruit & Vegetable Chem. Lab., Agric. Res. Service, USDA, Pasadena, California 91106, USA]

Limonin is sometimes responsible for bitterness in processed citrus products. A new limonoid-metabolizing enzyme, deoxylimonin hydrolase, was isolated from cell-free extracts of *Pseudomonas* 3218 by  $(\text{NH}_4)_2\text{SO}_4$  precipitation followed by 3 applications of DEAE-cellulose column chromatography. This enzyme catalyses the hydrolysis of deoxylimonin to form deoxylimononic acid and apparently attacks only the closed D ring of deoxylimonin. The enzyme requires no cofactor and its activity is optimal at pH 8.0-8.5. The enzyme possesses SH groups, which are involved in its catalytic action. AS





## 18

**Repression of *Vibrio parahaemolyticus* by *Pseudomonas* species isolated from processed oysters.**

Goatcher, L. J.; Westhoff, D. C.

*Journal of Food Science* 40 (3) 533-536 (1975)  
[24 ref. En] [Dept. of Dairy Sci., Univ. of Maryland, College Park, Maryland 20742, USA]

45 cultures isolated from processed Maryland oysters stored at 5°C were examined for inhibitory activities against various strains of *V. parahaemolyticus* by a spot-plate method. 9 oyster isolates which demonstrated inhibitory activity were identified as *Pseudomonas* species. Inhibition was more pronounced at 25°C than at 35°C and increased with decreasing levels of *V. parahaemolyticus*. Type and composition of plating medium, including pH, salt and peptone content, were important factors. Inhibition was max. at 0.5% NaCl and decreased with increasing salt concn. until little or no inhibition was observed at 2.5% NaCl. Effect of pH was variable according to strain of *V. parahaemolyticus* used. Addition of trypticase or phytone to tryptone-glucose-yeast extract agar decreased inhibition to different degrees. Pigmentation of *Pseudomonas* cultures was strong when production of inhibition was max. In general, pathogenic strains of *V. parahaemolyticus* tested were inhibited to a lesser degree than were non-pathogenic strains. IFT

## 19

**[Studies on the spoilage of fish jelly products. III. Browning of kamaboko by *Pseudomonas* sp.]**

Mori, K.; Nabetani, O.; Hirano, T.

*Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi]* 40 (9) 959-962 (1974) [8 ref. Ja, en] [Nippon Shinyaku Co. Ltd., Food Res. Inst., Nishioji-dori, Minami-ku, Kyoto, Japan]

Studies on bacterial browning of kamaboko are described; an organism responsible for browning was isolated, and identified as *Pseudomonas* sp. The characteristics of this organism were markedly different from those of other bacteria known to cause browning of kamaboko (*Achromobacter brunificans*, *Serratia marcescens*). This *Pseudomonas* sp. caused browning of kamaboko (containing either glucose or sucrose) during incubation for 1-2 days. [See following abstr. for part IV.]

AS

## 20

**[Studies on the spoilage of fish jelly products. IV. Browning of kamaboko by *Pseudomonas* sp.]**

Nabetani, O.; Hirano, T.; Mori, K.

*Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi]* 40 (9) 963-967 (1974) [8 ref. Ja, en] [Nippon Shinyaku Co. Ltd., Food Res. Inst., Nishioji-dori, Minami-ku, Kyoto, Japan]

It has been reported previously that the bacterial browning of kamaboko is probably due to the amino-carbonyl reaction between carbohydrates and amino compounds, but the detailed mechanism

of this reaction has not yet been clarified. The precursor of the browning substance produced by *Pseudomonas* sp. isolated from browning kamaboko was investigated in order to clarify the mechanism of browning. It was recognized that the precursor was derived from glucose and not from the amino acids tested, and it was confirmed by paper chromatography that the precursor was acidic and has a strong reducing activity. This precursor reacted nonenzymatically with  $\epsilon$ -amino-n-caproic acid or acidic amino acids to produce the browning substance. It is likely that this precursor is 2,5-diketogluconic acid or a related compound. [See preceding abstr. for part III.] AS

## 21

**[Indole-producing aerobic/anaerobic flora in packaged pasteurized milk, (particularly *Aeromonas*).]**

Veillet-Poncet, L.

*Lait* 54 (537) 409-414; (538) 537-552; (539/540) 675-684 (1974) [Fr]

This paper is a reproduction of information contained in a thesis with the same title, presented to the University of Nancy, France, in Dec. 1973. The taxonomy and systematic position of the genus *Aeromonas*, the frequency and importance of aeromonads as contaminants, the coagulating and proteolytic properties and action on milk, and their significance in milk technology are discussed. The indole-producing bacteria most frequently found in packaged pasteurized milk were *A. punctata* and its subspecies *caviae*, and *A. hydrophyla* and its subspecies *anaerogenes*. CDP

## 22

**Characterization of phospholipases C produced by psychrotrophic bacteria from homogenized milk. [Lecture]**

Fox, C. W.; Marshall, R. T.

*Journal of Dairy Science* 58 (5) 794 (1975) [En] [Univ. of Missouri, Columbia, Missouri, USA]

For 11 phospholipases C, activation energies were 9.5-18.6 kcal/mol; after heating for 30 min at 60°C, activities were <10% to 107% of the initial values. The enzyme most likely to be active in refrigerated, pasteurized milk and in cultured milk products was produced during log phase growth by *Pseudomonas fluorescens* 14; it had an activation energy of 10.1 kcal/mol, was 75% as active at pH 5.3 as at pH 6.7, and was activated by  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$  and  $\text{Zn}^{2+}$ . [See 7 11P2324.] JMD

## 23

**Interactive effects of lipase and microbial phospholipase C on fat globules of milk and model milk. [Lecture]**

Chrisope, G. L.; Marshall, R. T.

*Journal of Dairy Science* 58 (5) 794-795 (1975) [En] [Univ. of Missouri, Columbia, Missouri, USA]

Phospholipase C from *Pseudomonas fluorescens* hydrolysed phospholipids in model milk, composed of butter oil emulsified with lecithin. The treatment



enhanced subsequent lipolysis with steapsin. The phospholipase increased the activity of milk lipase in raw milk, with possible cow to cow and breed to breed variations in response. [See 7 11P2324.] JMD

## 24

**Action of heat-stable *Pseudomonas fluorescens* protease on sterilized skim milk.** [Lecture]

Malik, A. C.; Swanson, A. M.

*Journal of Dairy Science* 58 (5) 795 (1975) [En] [Univ. of Wisconsin, Madison, Wisconsin, USA]

3 strains of *Ps. fluorescens*, isolated from raw milk, were inoculated into skim-milk, stored at 7°C and sterilized at 132°C for 110 s. Then 2.5-50% of each of the 3 stored sterilized milks were added to fresh skim-milk and sterilized at 132°C for 110 s. Enzymic proteolysis and storage separation were observed in most of the sterilized milk samples. [See 7 11P2324.] JMD

## 25

**Properties of crude ethyl ester-forming enzyme preparations from some lactic acid and psychrotrophic bacteria.**

Hosono, A.; Elliott, J. A.

*Journal of Dairy Science* 57 (12) 1432-1437 (1974) [10 ref. En] [Food Res. Inst., Canada Dept. of Agric., Ottawa, Canada]

Crude esterase preparations were obtained from 3 strains of lactic acid bacteria and 2 of *Pseudomonas* spp., which had previously shown a relatively high level of esterase production [FSTA (1974) 6 10P1433]. Optimum pH for enzyme activity was 6.5 for *Lactobacillus* strain 81, 7-7.5 for *Str. diacetylactis* ATCC 15346 and *Str. lactis* ML3, and 8 for *Pseudomonas* strains 50 and 53; optimum temp. in each case was 32°C. Enzyme activity of all strains was inhibited by  $\text{Cu}^{2+}$ ,  $\text{Mn}^{2+}$  and  $\text{Co}^{2+}$ , the effects of  $\text{Co}^{2+}$  on *Str. lactis* ML3 and the *Pseudomonas* enzymes and of  $\text{Cu}^{2+}$  on *Lactobacillus* 81 enzyme being significant. It is suggested that these enzymes may be involved in the development of fruity flavours. CDP

## 26

**Contamination of shellfish with strains of *Pseudomonas aeruginosa* and specific bacteriophages.**

Denis, F. A.

*Canadian Journal of Microbiology* 21 (7) 1055-1057 (1975) [13 ref. En, fr] [Virology & Bact. Lab., Centre Hospitalier Univ., La Miletie, 86021, Poitiers, France]

*Ps. aeruginosa* and its corresponding bacteriophages were sought in oysters and mussels throughout 1973, 48% of the oysters and 74% of the mussels examined during the last half of the year contained *Ps. aeruginosa*; serotype P<sub>3</sub> was predominant. % of oysters contaminated by

bacteriophages active on *Ps. aeruginosa* increased throughout the year, from 0-4% between Jan. and May to 69% in Nov. The author was unable to establish a significant relationship between the presence of the bacterium and that of its specific bacteriophages in the shellfish. AS





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FAB 43

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H. BROOKES

ASSISTANT EDITOR





1

**Isolation of *Aeromonas* sp. ATCC 29063, a phenol-producing organism, from fresh haddock.**

Chen, T. C.; Levin, R. E.

*Applied Microbiology* 30 (1) 120-122 (1975) [5 ref. En] [Dept. of Food Sci. and Nutr., Univ. of Massachusetts, Amherst, Massachusetts 01002, USA]

Studies on phenol-producing bacteria in haddock are described. Phenol was detected in haddock fillets after storage for 8 days at 2°C or 4 days at 20°C. The mixed bacterial flora from a stale haddock fillet produced phenol in fish juice; no phenol-forming organism could be isolated from stale haddock. A phenol-forming organism was, however, isolated from fresh haddock; this is thought to be a new species, *Aeromonas* ATCC 29063. Morphological and growth characteristics of this sp. are briefly discussed. The absence of this sp. from stale haddock may be due to its relatively slow growth at low temp. AJDW

2

**Role of bacteria in bioaccumulation of mercury in the oyster *Crassostrea virginica*.**

Sayler, G. S.; Nelson, J. D., Jr.; Colwell, R. R.

*Applied Microbiology* 30 (1) 91-96 (1975) [20 ref. En] [Dept. of Microbiol., Univ. of Maryland, College Park, Maryland 20742, USA]

Aquarium studies on the effects of the presence of (i) Hg-reducing and (ii) Hg-accumulating strains of *Pseudomonas* spp. (isolated from Chesapeake Bay) on uptake of Hg from water by oysters are described. Oysters were held in water containing 10 µg <sup>203</sup>HgCl<sub>2</sub>/l. for 4 days, in the presence of (i), (ii) or the normal bacterial flora. Tables of values are given for Hg concn. in the whole body, mantle fluid, mantle, gills, viscera and adductor muscle of the various groups of oysters. The results showed that the presence of (i) and (ii) increased Hg uptake by oysters by approx. 50% and 100% respectively. The greatest increase in Hg concn. was in the gills and labial palps; increases in Hg concn. in the adductor muscle were relatively small. AJDW

3

**Bacteriocin typing of *Pseudomonas putrefaciens* from food, human clinical specimens and other sources.**

Williams, J. L.; Levin, R. E.

*Antonie van Leeuwenhoek* 41 (1) 97-100 (1975) [7 ref. En] [Univ., Massachusetts, Amherst, Massachusetts 01002, USA]

Having demonstrated previously that strains of *Pseudomonas putrefaciens* from different sources fall into 2 groups on the basis of DNA base composition, the authors have now developed a bacteriocin typing scheme for distinguishing low G + C from high G + C strains. 35 out of 38 low G + C isolates, including a number isolated from meat, fish, eggs and dairy products, fell in the 2

bacteriocin sensitivity patterns of + + + + and + + + - and bacteriocin typing was able to distinguish most of the high G + C isolates from the low G + C isolates, regardless of origin. EJM

4

**Heat resistant proteases produced in milk by psychrotrophic bacteria of dairy origin.**

Adams, D. M.; Barach, J. T.; Speck, M. L.

*Journal of Dairy Science* 58 (6) 828-834 (1975) [15 ref. En] [Dept. of Food Sci., N. Carolina St. Univ., Raleigh, N. Carolina 27607, USA]

Production of heat-resistant proteases by psychrotrophs growing in milk, resistance of such proteases to UHT treatments and action of these enzymes on milk were studied. All of the psychrotrophs obtained from raw milk produced proteases that survived 149°C for 10 s; 70-90% of the raw milk samples contained psychrotrophs capable of producing heat-resistant proteases. The protease chosen as a model was resistant to heat treatments at 110-150°C, and the inactivation parameters suggested that thermal destruction of heat-resistant proteases would damage the milk severely. Casein content and pH of normal milk were suitable for protease action, and the protease was quite active at normal [25°C] and elevated room temp. The protease rapidly spoiled sterile milk with the development of bitter flavour, clearing, or coagulation; and the susceptibility of sterile milk to protease increased during storage of the milk. AS

5

**Improvements in a non-proprietary radiometric medium to allow the detection of some *Pseudomonas* species and *Alcaligenes faecalis*.**

Previte, J. J.; Rowley, D. B.; Wells, R.

*Applied Microbiology* 30 (2) 339-340 (1975) [19 ref. En] [Biol. Dep., State Coll., Framingham, Massachusetts 01701, USA]

The metabolism of [<sup>14</sup>C]-labelled substrate to [<sup>14</sup>CO<sub>2</sub>] has been used to detect vegetative bacteria and spores and to evaluate the inhibitory effects of antibiotics on bacterial growth. It also constitutes a potential technique for rapidly estimating the total number of aerobic, mesophilic bacteria and anaerobic spores in food. The present study indicated that it is possible to detect non-fermenters of glucose such as *Pseudomonas fluorescens*, *Ps. aeruginosa* and *Alcaligenes faecalis* by adding [5-<sup>14</sup>C]-labelled glutamate and [<sup>14</sup>C]-labelled formate to a non-proprietary broth containing [<sup>14</sup>C]-labelled glucose, trypticase, yeast extract, thiotone and salts, without interfering with the detection of aerobic and anaerobic spore-formers and non-spore-formers. *Ps. diminuta* could also be detected when [<sup>14</sup>C]-labelled pyruvate was added. [See also FSTA (1975) 7 1B8.] FSB





## 6

**Evaluation of a most-probable-number technique for the enumeration of *Pseudomonas aeruginosa*.**

Highsmith, A. K.; Abshire, R. L.

*Applied Microbiology* 30 (4) 596-601 (1975) [30 ref. En] [Cent. for Disease Control, Atlanta, Georgia 30333, USA]

A MPN technique was evaluated for detecting and enumerating *Ps. aeruginosa* in water and wastewater. Both the presumptive and confirmatory media, as described in the 13th edition of Standard Methods for the Examination of Water and Wastewater [American Public Health Association Inc., New York (1971)] as well as modifications of these media were included in evaluations. Various samples of water were tested, namely chlorinated tap water, creek water, and influent to a wastewater treatment plant. Modified media repeatedly gave higher estimated MPNs than *Ps. aeruginosa* than media listed in Standard Methods. *Ps. aeruginosa* was detected and recovered from all creek water and wastewater samples, but not from tap water samples. This organism was determined to be present in as large numbers as faecal coliforms and in even greater quantities than the faecal streptococci in all samples, whenever MPN estimations were determined from those positive tubes containing modified confirmatory medium. AS

## 7

**Fermentation protein from methanol.**

Young, R. J.

*Abstracts of Papers, American Chemical Society* 169, INDE 82 (1975) [En] [Imperial Chem. Ind. Ltd. (Agric. Div.), Billingham, Cleveland, TS23 1LB, UK]

A process for producing single-cell protein (SCP) from a methanol substrate and a pseudomonad is outlined. Methanol at the present time is most economically made from natural gas. The pseudomonad has a higher growth rate and a higher protein content than has yeast. Fermentation is carried out at pH 7, making use of stainless steel unnecessary. A higher optimum growth temp. simplifies the cooling problem. The process employs a continuous air-lift fermenter of novel design in which the broth is subjected to variations of pressure thus alternately facilitating the solution of O<sub>2</sub> and evolution of CO<sub>2</sub>. Process operating costs are low because of the low cost of substrate, high C efficiency (60%), and low energy requirement arising from absence of mechanical stirring and relatively good O<sub>2</sub> efficiency. Capital cost is low because of high productivity, use of a large single stream fermenter, and the compact nature of the novel harvesting system. Extensive animal feeding trials have shown the product to have no toxic properties and a nutritional value greater than that of soybean meal on an isonitrogenous basis of comparison. It is planned that the first commercial plant, with a capacity of  $\geq 100\ 000$  tons/yr, shall be operating in Europe in 1977. AS

## 8

**Amylases from *Pseudomonas stutzeri*. Affinity chromatography of exo-maltotetrahydrolase using Sephadex G-100 as an adsorbent.**

Dellweg, H.; John, M.; Schmidt, J.

*European Journal of Applied Microbiology* 1 (3) 191-198 (1975) [8 ref. En] [Inst. für Gärungsgewerbe & Biotech., Seestrasse 13, D-1000 Berlin (West) 65]

Purification and characterization of an exoamylase from *Pseudomonas stutzeri* are described. The enzyme, which has a high specificity to  $\alpha$ -1,4- glucosidic linkages, was found to be bound to  $\alpha$ -1,6-linked dextrans and was easily separated from other proteins by absorption to Sephadex G-100 and subsequent elution with a salt gradient or a starch containing buffer. Behaviour of the *Pseudomonas stutzeri* amylase is compared to that of other amylases. AS

## 9

**Peroxidized flavor and acidic fraction of rice vinegar.**

Yamaguchi, G.; Masai, H.

*Agricultural and Biological Chemistry* 39 (10) 1907-1911 (1975) [6 ref. En]

As a potent producer of peroxidized flavour, *Acetobacter* No. 112 was selected out of 103 strains. It was classified according to Bergey's, Frateur's and Yamada's methods and identified as *Acetobacter xylinum*. The peroxidized flavour was generated only in a medium containing acetic acid. It was shown by GLC/MS that the compounds of peroxidized flavour were propionic acid, isobutyric acid, etc. Non-volatile acids were analysed by liquid chromatography. Gluconic and oxalic acids were found in greater amounts in vinegar brewed by shaking culture; malic and citric acids were predominant in peroxidized vinegar; and glycollic and lactic acids were predominant in vinegar brewed by surface culture. AS

## 10

**[Proteolysis of milk and milk products by *Pseudomonas fluorescens*.] Proteolyse von Milch und Milchprodukten durch *Pseudomonas fluorescens*. [Lecture]**

Kielwein, G.

*Milchwissenschaft* 30 (10) 605-606 (1975) [De, en] [Abteilung Hygiene der Milch, Fische & Eier, Univ. Giessen, Federal Republic of Germany]

Brief information is given on experiments with 2 variants of *Pseudomonas fluorescens*, subsp. *anhaem.* and *haem.* They grow well in milk, producing however little enzyme at  $<8^{\circ}\text{C}$ ; the proteases were not active at pH  $<5.4$ . Proteolysis affected particularly  $\alpha_1$ -casein and  $\beta$ -lactoglobulin. The proteases were relatively heat-stable, and it is considered that even UHT processing may not ensure complete inactivation of *Ps. fluorescens* proteases. FL





## 11

**Synthesis of higher alcohols in the genus *Zymomonas*.**

Beyers, J.; Verachtert, H.

*Journal of the Institute of Brewing* 82 (1) 35-40 (1976) [17 ref. En] [Lab. of Ind. Microbiol. & Biochem., Univ. of Leuven, Kardinaal Mercierlaan, 92 Heverlee-Louvain, 3030, Belgium]

Several strains of *Zymomonas* were examined with respect to their potential for higher alcohol synthesis. All strains studied were able to produce higher alcohols during growth in a simple medium containing glucose and yeast extract. The higher alcohols produced were mainly n-propanol and iso-amyl alcohol. In contrast to *Saccharomyces cerevisiae*, only trace amounts of higher alcohols were produced from glucose by resting cells. When amino acids or other precursors were added to the fermentation medium, the resting cells formed higher alcohols. The stimulation of n-propanol synthesis by precursors was the most pronounced. The results obtained indicate that, with minor differences, the mechanisms of higher alcohol synthesis are comparable to those used by yeasts. AS

## 12

**Effect of heat treatments and days of storage on psychrotrophic growth and selected components of milk.**

Weckbach, L. S.

*Dissertation Abstracts International, B* 36 (3) 1075: Order no. 75-18524 (1975) [En] [Kentucky Univ., Lexington, Kentucky 40506, USA]

Raw milk was heated at 72°C for 15 s, 79°C for 15 s, 88°C for 10 s or 95.5°C for <5 s, inoculated with a strain of *Pseudomonas* and stored for 0, 7 and 14 days. Heat treatment of the milk, initial cell inoculum, days of storage and plating media had significant ( $P < 0.01$ ) effects on the psychrotrophic count; changes in fatty acids, non-casein N and  $\beta$ -lactoglobulin were also studied. LMB

## 13

**Repression of *Vibrio parahaemolyticus* by *Pseudomonas* species isolated from processed Maryland oysters (*Crassostrea virginica*).**

Goatcher, L. J. T.

*Dissertation Abstracts International, B* 36 (6) 2625: Order No. 75-27787 (1975) [En] [Univ. of Maryland, College Park, Maryland, USA]

## 14

**A strain of *Pseudomonas aeruginosa* resistant to a quaternary ammonium compound. I. Physiological properties.**

Washam, C. J.; Sandine, W. E.; Elliker, P. R.

*Journal of Milk and Food Technology* 39 (2) 101-106 (1976) [36 ref. En] [Dep. of Microbiol., Oregon State Univ., Corvallis, Oregon 97331, USA]

## 15

**Single-cell protein production by photosynthetic bacteria cultivation in agricultural by-products.**

Shipman, R. H.; Kao, I. C.; Fan, L. T.

*Biotechnology and Bioengineering* 17 (11) 1561-1570 (1975) [12 ref. En] [Dep. of Chem. Eng., Kansas State Univ., Manhattan, Kansas 66506, USA]

The growth of the non-sulphur photosynthetic bacterium *Rhodospseudomonas gelatinosa* on various agricultural by-products (corn starch, potato starch wastes, molasses and wheat bran) was investigated. Wheat bran was chosen as a substrate for mass culture and continuous cultivation studies. Harvested photosynthetic cells contained approx. 65% crude protein and 5.1% nucleic acid (RNA). The amino acid content of harvested photosynthetic proteins was comparable with conventional proteins of plant and animal origin. AS

## 16

**[O- $\alpha$ -glucopyranosyl-(1 $\rightarrow$ 5)-D-arabinofuranose - a disaccharide synthesized by bacterial enzyme action.] O- $\alpha$ -Glucopyranosyl-(1 $\rightarrow$ 5)-D-arabinofuranose - ein bakteriell-enzymatisch synthetisiertes Disaccharid.**

Mauch, W.; El-Aama, F.

*Zeitschrift für die Zuckerindustrie* 26 (1) 21-25 (1976) [31 ref. De, en, es, fr] [Inst. für Zucker Ind., Amrumer Strasse 32, D-1000 Berlin (West) 65]

A previously unknown disaccharide synthesized in about 6% proportion from a mixture of sucrose and D-arabinose by the pseudomonad *Protaminobacter ruber* was separated from the main reaction product iso-maltulose and characterized by physical, chemical and spectroscopic methods. RM

## 17

**[Acetic acid bacteria and their uses. XII.****Characteristics of acetic acid bacteria isolated from vinegar mash.]**

Yanagita, T.; Suminoe, K.

*Journal of the Society of Brewing, Japan [Nihon Jozo Kyokai Zasshi]* 70 (3) 185-191 (1975) [24 ref. Ja]

17 *Acetobacter aceti*, 10 *A. rancens*, 3 *A. pasteurianus*, 22 *A. kuetzingianus*, 2 *A. suboxydans* and 4 *A. oxydans* strains were isolated from vinegar mash and their characteristics were investigated. Of the 58 strains, 41 grew on a medium containing 35-40% glucose and 43 grew on a medium containing 10-11% alcohol. They were classified into 1.5-2.0% and 2.0-2.5% acetic acid tolerant groups. [See FSTA (1975) 7 12T616 for part XI.] YN





## 18

[Taxonomy of aeromonads from milk and other foods.] Taxonomie der Aeromonaden aus Milch und sonstigen Lebensmitteln.  
Kleeberger, A.

*Milchwissenschaft* 30 (10) 602-603 (1975) [4 ref. De, en] [Bakt. Inst. der Südd. Versuchs- & Forschungsanstalt für Milchwirtschaft, Weihenstephan, Federal Republic of Germany]

101 strains from milk, 161 from water and 103 from minced meat were tested for 24 properties characteristic of *Aeromonas hydrophila*. Results suggest the possibility of characterizing aeromonads from foods on the basis of their different lysine decarboxylase activities, and also demonstrate the suitability of numerical taxonomy for studying this group of organisms. CDP

## 19

Effects of temperature and nutrients on proteinase production by *Pseudomonas fluorescens* and *Ps. aeruginosa* in broth and milk.

Juffs, H. S.

*Journal of Applied Bacteriology* 40 (1) 23-32 (1976) [14 ref. En] [Otto Madsen Dairy Res. Lab., Div. of Dairying, Hamilton, Queensland 4007, Australia]

Temp. and composition of the medium influenced the production of proteinase by *Ps. fluorescens* and *Ps. aeruginosa* isolated from raw milk. Many isolates of *Ps. fluorescens* digested litmus milk at 10° but not at 5° or 2°C. With *Ps. fluorescens* proteinase production/unit of growth in Peptone-Yeast Extract broth declined progressively as the incubation temp. was reduced from 20° to 5°C. At 30°C there was heavy growth in the same medium but only slight proteinase production whereas enzyme production by *Ps. aeruginosa* was max. at this temp. In media containing either sodium caseinate, Hammarsten casein or lactalbumin as the sole organic constituent, proteinase was produced in small amounts; production was increased when peptone was added but inhibited by glucose and to a lesser extent lactate. In milks seeded with these pseudomonads, the extent of proteolysis was either increased markedly or slightly decreased when glucose was included. AS

## 20

Roles played by bacterial and autolytic enzymes in the production of volatile sulphides in spoiling North Sea cod (*Gadus morhua*).

Herbert, R. A.; Shewan, J. M.

*Journal of the Science of Food and Agriculture* 27 (1) 89-94 (1976) [28 ref. En] [Torry Res. Sta., Min. of Agric., Fisheries & Food, 135 Abbey Road, Aberdeen AB9 8DG, UK]

The roles played by bacterial and autolytic enzymes in the production of volatile sulphide (hydrogen sulphide, methyl mercaptan and dimethyl sulphide) in spoiling iced cod were investigated. The data show that the volatile sulphides arise as the result of the microbial

degradation of cyst(e)ine and methionine. 13 *Pseudomonas* spp. were investigated. All liberate hydrogen sulphide and methyl mercaptan. In addition to methyl mercaptan formation from methionine, 6 strains also produce dimethyl sulphide. There is no evidence to show that autolytic enzymes are directly involved in the production of volatile sulphides in chill-stored North Sea cod. [See also FSTA (1976) 8 2R103 & 2R104.] AS

## 21

[Volatiles produced by three pseudomonads isolated from spoiled poultry.]

Freeman, L. R.; Silverman, G. J.; Angelini, P.

*Abstracts of the Annual Meeting of the American Society for Microbiology* 75, 204 (1975) [En] [Brigham Young Univ., Provo, Utah, USA]

Volatiles produced by 3 fluorescent pseudomonads isolated from poultry spoiled at 10°C for 5 days were obtained by using high-vacuum, low-temp. distillation techniques and further separated and identified using combined GLC and MS. 2 of the 3 isolates were classified as *Pseudomonas fluorescens* cultures and the third as *Ps. putida*. Each culture was inoculated onto both irradiated sterile chicken muscle (1.5 Mrad) and trypticase soy agar supplemented with yeast extract (TSY). Following the incubation period the volatiles were isolated and identified. One of the *Ps. fluorescens* cultures produced HCN, dimethyl disulphide (DMDS), dimethyl sulphide (DMS), ethyl acetate, methyl propionate, and methyl thioacetate when grown on both the substrates. The second *Ps. fluorescens* culture produced ethanol, methanol, and HCN on the muscle; but on the TSY agar, ethanol, HCN, and DMS were identified. The *Ps. putida* culture produced DMDS on the TSY agar and DMDS, methanol, ethanol, and heptadiene on the muscle. appeared appeared that the 2 *Ps. fluorescens* cultures were different strains on the basis of differences in their metabolic products. However, both cultures were capable of producing HCN on the 2 substrates while the *Ps. putida* culture produced no detectable HCN on either substrate. AS

## 22

Metabolism of limonoids. Limonin D-ring lactone hydrolase activity in *Pseudomonas*.

Hasegawa, S.

*Journal of Agricultural and Food Chemistry* 24 (1) 24-26 (1976) [13 ref. En] [Fruit and Vegetable Chem. Lab., W. Region, USDA, Pasadena, California 91106, USA]

*Pseudomonas* sp. 321-18 possesses a limonin D-ring lactone hydrolase similar to that isolated from grapefruit seeds. The 2 enzymes have similar pH optima for both hydrolysis and lactonization, and also have similar substrate specificities. However, they differ greatly in heat resistance. AS





## 23

[Detection of aeromonads of the *Aeromonas hydrophila* and *A. punctata* group during hygienic evaluation of drinking water.] Der Nachweis von Aeromonaden der 'Hydrophila-Punctata-Gruppe' im Rahmen der hygienischen Trinkwasserbeurteilung. Schubert, R.

*Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, IB* 161 (5/6) 482-497 (1976) [11 ref. De, en] [Klinikum der Johann Wolfgang Goethe-Univ., Frankfurt a.M., Federal Republic of Germany]

This is a very detailed study of aeromonad incidence in 5 groups of wells (7-23 wells/group) and a discussion of the evidence indicating a connection between presence of anaerogenic aeromonads and sewage pollution of water. Within the 5 groups of wells considered, aerogenic aeromonads were not found in those from deep subsoil water but were present to a greater or lesser extent in those from near-surface subsoil water. Aerogenic aeromonads were also present in ground water filtrate at some distance from the banks of sewage-polluted rivers. On the other hand, anaerogenic aeromonads constituted  $\leq 80\%$  of the population of flowing waters polluted with sewage. It is therefore concluded that presence of anaerogenic aeromonads proves sewage contamination of ground water. SKK

## 24

*Enterobacteriaceae* and *Pseudomonas aeruginosa* recovered from vegetable salads.

Wright, C.; Kominos, S. D.; Yee, R. B.

*Applied and Environmental Microbiology* 31 (3) 453-454 (1976) [12 ref. En] [Div. of Microbiol., Mercy Hospital, Pittsburgh, Pennsylvania 15219, USA]

*Klebsiella*, *Enterobacter*, and *Serratia* were recovered frequently in high counts from vegetable salads. *Ps. aeruginosa*, although isolated frequently, had lower counts. AS

## 25

A process for manufacture of microbial protein concentrate from solid hydrocarbons.

India, Council of Scientific and Industrial Research *Indian Patent* 138 005 (1976) [En]

A protein-rich microbial biomass is produced from slack wax containing 10-15% lube oil, or paraffin wax containing 0-0.5% lube oil. A suitable bacterium of the genus *Pseudomonas* is cultivated at 37°C and pH 6.8-7.0 in aqueous nutrient medium containing assimilable sources of N, phosphate, trace minerals, growth factors and solid hydrocarbons, e.g. slack wax or paraffin wax, as the only source of C. The unused substrate is incorporated in the growth medium in the emulsified stage, the culture broth is heated to 70°C at the end of fermentation and cooled to room temp. to separate the cells. The cell biomass is then dried. W&Co

## 26

Production of limonoate dehydrogenase by *Pseudomonas*.

Hasegawa, S.; Kim, K. S.; Border, S. N.; Brewster, L. C.; Maier, V. P.

*Journal of Food Science* 41 (3) 706-708 (1976) [10 ref. En] [USDA, Fruit & Vegetable Chem. Lab., Pasadena, California 91106, USA]

The growth conditions of *Pseudomonas* sp. 321-18 were studied to maximize yields of limonoate dehydrogenase, which prevents the development of limonin bitterness in citrus juices. The organism grew well on 0.5% or less limonoate media, but it did not grow on media containing 1.0% or more limonoate. Galactose and fructose were excellent substrates for its growth, but sucrose and glucose were found to be poor. The organism grew best at 25°C and pH 7-7.5. Cells grown on substrates other than those containing limonoids did not produce limonoate dehydrogenase, but the enzyme was induced with low concn. of limonoids. Enzyme activity was increased 5- to 6-fold by use of the induction method on galactose grown cells. [See also FSTA (1974) 6 9H1498.] IFT

## 27

[Catalase test for detection of psychrotrophic organisms in UHT-treated milk.]

Matsumoto, M.; Zinbo, K.; Haruta, M.

*Annual Report of Tokyo Metropolitan Research Laboratory of Public Health* 23, 161-168 (1971, publ. 1972) [14 ref. Ja, en] [Dep. of Food Hygiene and Nutr., Tokyo Metropolitan Res. Lab. of Public Health, Tokyo, Japan]

Psychrotrophic organisms are mostly catalase-positive and there is a quantitative relationship between catalase activity and the number of psychrotrophs present; hence catalase activity can be used as an indicator of psychrotroph contamination of UHT-treated milk. 2 ml of a 0.03% solution of  $H_2O_2$  were added to the UHT-treated milk sample and allowed to stand at 25°C for 2 h (or 24 h for detection of small numbers of psychrotrophs). 2 ml of 70% trichloroacetic acid was then added followed by filtration and detn. of the % of  $H_2O_2$  degraded (a measure of catalase activity). When psychrotrophs were presented in the order of  $10^5$ /ml UHT-treated milk,  $H_2O_2$  began to be decomposed by the catalase produced. The relationships between milk quality and growth of *Pseudomonas fluorescens* in sterilized milk at 5° and 10°C are also tabulated. [From En summ. and tables.] LMB

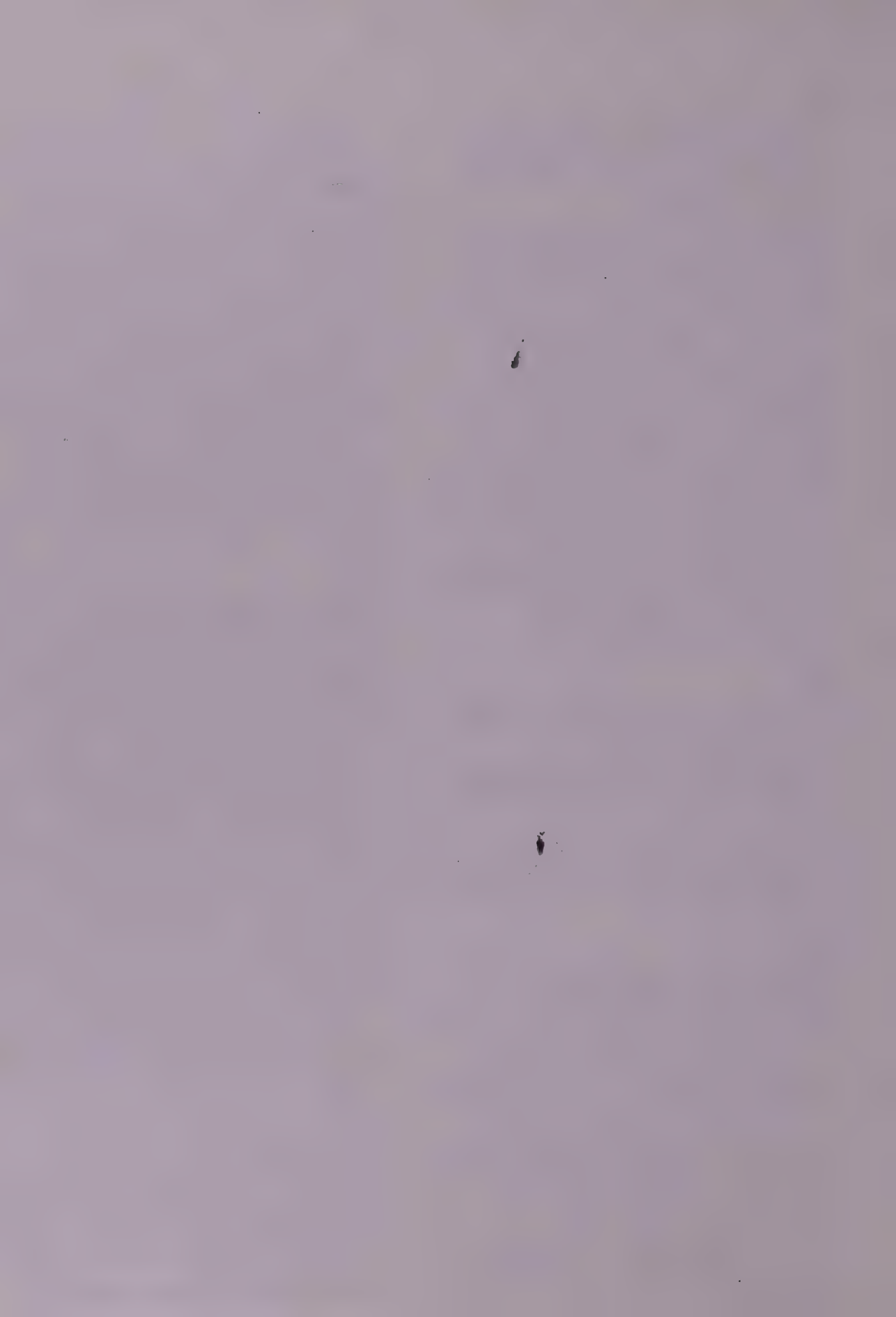
## 28

[Occurrence of pathogenic microorganisms in Cottage cheese.]

Maleszewski, J.; Bachryj, F.; Bawlik, I.; Borowiak, M.; Czarnowska, W.; Chybowski, J.; Dziurawik, Z.; Fraskiewicz, B.; Glowacki, M.; Jedrzejowska, H.; Klos, J.; Koc, T.; Krzeminska, B.; Lewicka, J.; Lichocinska, H.; Maciaszek, A.; Smykal, B.; Wilczynska-Stelmach, W.

*Roczniki Państwowego Zakładu Higieny* 27 (2)





147-151 (1976) [13 ref. Pl, ru, en] [Zakład Badania Żywności i Przedmiotów Użytku Panstwowego Zakład Higieny, Warsaw, Poland]

995 samples of twarog cheese were examined. Coagulase-positive staphylococci were found in 7.8% of 587 high-fat factory cheeses, 6.6% of 202 low-fat factory cheeses and 9.9% of 306 farm cheeses. Haemolytic streptococci were found only in 7.3% of the low-fat factory cheeses, and *Pseudomonas aeruginosa* in 2.5% of the high-fat cheeses. *Escherichia coli* were found in about 40-45% of each group of samples. No *Salmonella* organisms were found. Contamination with moulds was most frequent in the farm cheeses. ADL

## 29

The stability of lipase in the supernatant of *Pseudomonas fluorescens* as a function of time of incubation and heat treatment.

Jonsson, U.; Snygg, B. G.

*Chemie Mikrobiologie Technologie der Lebensmittel* 4 (6) 173-176 (1976) [16 ref. En, de, fr] [SIK, Swedish Inst. for Food Preservation Res., Göteborg, Sweden]

## 30

A strain of *Pseudomonas aeruginosa* resistant to a quaternary ammonium compound. II. Factors influencing degree of resistance.

Washam, C. J.; Sandine, W. E.; Elliker, P. R. *Journal of Milk and Food Technology* 39 (4) 273-279 (1976) [35 ref. En] [Dep. of Microbiol., Oregon State Univ., Corvallis, Oregon 97331, USA]

See FSTA (1976) 8 7C337 for part I.

## 31

[Nutrient media for the bacteriological investigation of milk and dairy products.]

Kovacs, M. D.; Nagy, I.

*Élelmiszervizsgálati Közlemények* 21 (3) 133-141 (1975) [3 ref. Hu, ru, de, en, fr] [Tejtermékek Ellenorzo Allomaso, Budapest, Hungary]

The nutrient media, Colitrop and Eccotrop, suggested by L. Thiry [see Honvedorvos (1960) 12 (2) 113] proved to be suitable for simple and quick detection of Enterobacteriaceae (with the exception of *Salmonella typhi*), of Pseudomonadaceae, and of Enterococci in milk and dairy products. Colitrop was capable of detecting the presence of *E. coli* and of the coliform group at a sensitivity higher than that of other tested nutrient media. Eccotrop indicated the presence of Enterococci at a sensitivity higher than that of other media tested.

IF

## 32

Microbiological problems of poultry at refrigerator temperatures - a review.

Barnes, E. M.

*Journal of the Science of Food and Agriculture* 27 (8) 777-782 (1976) [24 ref. En] [Food Res. Inst., Colney Lane, Norwich, Norfolk NR4 7UA, UK]

The microbiological condition and changes which may occur during the storage of unviscerated (New York dressed) and eviscerated chicken and turkey carcasses are described. Whilst a number of different types of organisms which can grow at low temp. are generally found on eviscerated carcasses, it is the pseudomonads which are the most important in spoilage. The effect of temp., gaseous environment, pH and type of muscle on the growth of the spoilage organisms and hence the shelf-life of the carcass is discussed. AS

## 33

Aseptic technique for obtaining sterile beef tissue.

Buckley, J.; Morrissey, P. A.; Daly, M.

*Journal of Food Technology* 11 (4) 427-430 (1976) [10 ref. En] [Dep. of Dairy & Food Tech., Univ. Coll., Cork, Irish Republic]

A procedure for preparation of sterile beef is described. Cattle are slaughtered and eviscerated in the usual manner. The strip loin (lumbar) region of the longissimus dorsi is then excised using a sterile knife, and transported under sterile conditions to the laboratory. In a laminar air flow unit, the surface 2-3 cm layer is then removed, using sterile apparatus; sterile muscle tissue samples may then be removed from the exposed tissue surface. They are then ground, and 5 g samples are transferred to sterile 50 ml screw-cap bottles. Of 600 samples prepared by this method, only 2 have been found to be non-sterile. A table of data is given showing growth of *Enterobacter aerogenes* and non-pigmented pseudomonads (inoculated onto sterile minced beef) during holding for  $\leq 25$  days at 7°C; values for changes in pH are also given. AJDW





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FAB 43

PSEUDOMONADACEAE AND FOOD PROCESSING

SELECTED FROM VOLUME 9  
FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

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H. BROOKES

ASSISTANT EDITOR



## 1

**Lecithin agar for detection of microbial phospholipases.**

Chrisope, G. L.; Fox, G. W.; Marshall, R. T. *Applied and Environmental Microbiology* 31 (5) 784-786 (1976) [4 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Missouri, Columbia, Missouri 65201, USA]

19 Gram-negative isolates from rinse tests of cleaned milk processing equipment in a commercial dairy plant were tested for microbial phospholipase activity. A lecithin agar medium was developed on which *Pseudomonas fluorescens* 178 produced turbid zones suggesting phospholipase C activity, and strain 157 of an unknown species of *Pseudomonas* produced a clear zone attributable to phospholipase A. Reactions on lecithin agar agreed 74% of the time with reactions in egg yolk broth. On lecithin agar, interpretation was easier, phospholipase A was detectable, and opaque zones were visible 1 or 2 days earlier than on egg yolk agar. All constituents of the medium can be autoclaved. LMB

## 2

**Stabilization of a psychrotrophic *Pseudomonas* protease by calcium against thermal inactivation in milk at ultrahigh temperature.**

Barach, J. T.; Adams, D. M.; Speck, M. L. *Applied and Environmental Microbiology* 31 (6) 875-879 (1976) [17 ref. En] [Dep. of Food Sci., N. Carolina State Univ., Raleigh, N. Carolina 27607, USA]

The heat-stable extracellular protease of *Pseudomonas* sp. (isolate MC60) was investigated. Heat resistance of the enzyme in milk at sterilization temp. was dependent on the presence of  $\text{Ca}^{2+}$ . The half-life of the enzyme at UHT (149°C) in skim-milk or milk-salts buffer with  $\text{Ca}^{2+}$  was approx. 7.0 s. Treatment of milk with chelators completely removed the heat-stabilizing effect of milk. The enzyme was partially purified by ammonium sulphate precipitation and column chromatography on Sephadex G-100. At 21°C the enzyme retained >85% activity after exposure to pH values between 5 and 10. Enzyme activity was reduced by metal chelating agents. Both  $\text{Ca}^{2+}$  and  $\text{Zn}^{2+}$  were required for optimal enzyme activity. Mol. wt. was estimated at 48 000 by gel filtration. AS

## 3

**Influence of fat on the thermal destruction of bacteria in sausage products.**

Smith, J. L.; Metzger, W.; Palumbo, S. A. *Fleischwirtschaft* 56 (5) 687-690; 691-694 (1976) [13 ref. En, De] [E. Regional Res. Cent., Agric. Res. Service, USDA, 600 E. Mermaid Lane, Philadelphia, Pennsylvania 19118, USA]

The effect of fat on thermal destruction of microorganisms was studied in emulsion sausages (Frankfurters) and coarsely comminuted sausages with fat levels of 11-38%. Sausages were prepared from meat and fat containing high levels of either

*pseudomonads* of micrococci. Cumulative time and temp. of heating was determined by an integration method designated degree-minutes ( $^{\circ}\text{min}$ ). Plots of log surviving bacteria vs.  $^{\circ}\text{min}$  with the 2 types of sausages at various fat levels gave similar concave patterns. Statistical analysis of the data (restricted to the linear portion of the plots where log bacterial count was >2.0) indicated greater heat sensitivity of *pseudomonads* than micrococci, slightly deleterious effect of fat on bacterial survival during heating, and very little difference between heat destruction of bacteria in Frankfurters and in coarsely comminuted sausages. AS

## 4

**Antibiotic-resistant bacteria in raw meat from retail markets.**

Hankin, L.; Anagnostakis, S. L.; Redys, J. J. *Journal of Milk and Food Technology* 39 (7) 474-476 (1976) [6 ref. En] [Dep. of Biochem., Connecticut Agric. Exp. Sta., Box 1106, New Haven, Connecticut 06504, USA]

Raw meat samples [22 of ground beef, 1 of cube steak, 8 of pork sausage] from retail markets were examined for bacteria resistant to both chloramphenicol and neomycin sulphate. Total numbers of bacteria ranged from 17 000 to 30 000 000/g and resistant bacteria from <100 to 450 000/g. 12 isolates resistant to both antibiotics were identified as either *Pseudomonas aeruginosa*, *Ps. putida* or *Ps. fluorescens*. AS

## 5

**A strain of *Pseudomonas aeruginosa* resistant to a quaternary ammonium compound. III. Electron microscopy.**

Washam, C. J.; Sandine, W. E.; Elliker, P. R. *Journal of Milk and Food Technology* 39 (8) 546-550 (1976) [18 ref. En] [Dep. of Microbiol., Oregon State Univ., Corvallis, Oregon 97331, USA]

See FSTA (1976) 8 11C529 for part II.

## 6

**[The hygienic and technical significance of *Pseudomonas aeruginosa*.] Beitrag zur hygienischen und technologischen Bedeutung von *Pseudomonas aeruginosa*.**

Wienrich, E.

*Mineralbrunnen* 26 (3) 52, 54-55 (1976) [21 ref. De]

The hygienic significance of *Ps. aeruginosa* is discussed with reference to: the frequency of occurrence of this sp. in foods and in drinking water; sources of contamination; the lack of correlation of *Ps. aeruginosa* count with total count, *Escherichia coli* count or coliform count; pathogenicity of *Ps. aeruginosa*; and resistance of *Ps. aeruginosa* to heat and  $\text{Cl}_2$ . AJDW



7

**Microbiological production of proteinaceous material.**

Sumitomo Chemical Co. Ltd.

*British Patent* 1 444 072 (1976) [En]

Protein is produced by the cultivation of methanol assimilating microorganisms, particularly selected strains of *Pseudomonas utilis* or *Pseudomonas inaudita*, followed by the recovery of the cells from the fermentation broth. IFT

8

**Heat stable proteases from strains of *Pseudomonas fluorescens*.**

Malik, A. C.

*Dissertation Abstracts International*, B 36 (11)

5499-5500 Order No. 76-2494 (1976) [En]

[Univ. of Wisconsin, Madison 6, Wisconsin, USA]

*P. fluorescens* biotypes A, B and C were inoculated individually into skim-milk, incubated at 7°C for 4 days and then mixed with fresh skim-milk. This mixture was then sterilized at 132°C for 110 s. A 10-20% inoculum of contaminated skim-milk was sufficient to cause destabilization of stored sterilized skim-milk. A crude protease preparation, which survived 132°C for 110 s, was isolated by adding ammonium sulphate at 70% saturation to trypticase soya broth cultures of *P. fluorescens*. On further purification the properties of the enzyme were determined. Measurable milk-clotting (MCA) and proteolytic activity were present at temp.

100°C (optimum MCA at 45°C) and the enzyme when present in milk retained 44% activity after heating at 100°C for 10 min. Partially purified protease in skim-milk survived sterilization temp. of 132°C for 7 min. Divalent ions such as  $Pb^{2+}$  and  $Cu^{2+}$  inhibited protease to a marked degree. LMB

9

**Xanthan production from acid whey.**

Charles, M.

*Abstracts of Papers, American Chemical Society*

172, CARB 20 (1976) [En] [Dep. of Chem. Eng., Lehigh Univ., Bethlehem, Pennsylvania 18015, USA]

The permeate, obtained by ultrafiltration of Cottage cheese whey, was hydrolysed by immobilized lactase, yielding a solution containing 2.05% glucose, 2.05% galactose, 0.3% lactose, 0.3% protein, 0.5% lactic acid and 0.5% ash. After sterilization and supplementation with 0.5%  $K_2HPO_4$  and 0.01%  $MgSO_4 \cdot 7H_2O$ , the solution was inoculated with a culture of *Xanthomonas campestris*. After 90 h, yields of up to 3.6% xanthan gum were obtained from the culture liquor. MEG

10

**[*Pseudomonas*: causes and control.]**

Schindler, P. H.

*Meieriposten* 66 (1) 7-9 (1977) [No]

With increasing mechanization of milk treatment in Europe the proportion of non-acid-producing bacteria (such as *Pseudomonas*) in raw milk has increased greatly relative to the lactic acid bacteria (to a ratio of 12:1 in certain districts of Germany). Gram-negative, psychrotrophic pseudomonads naturally present in water can easily contaminate milk, making it very difficult to process, and pasteurization-resistant enzymes from these strains can rapidly cause spoilage under both aerobic and anaerobic conditions. The methylene blue test, which detects primarily acid-producing bacteria, gives a false picture of milk quality and is a poor basis for payment under such circumstances. Ways of controlling the pseudomonad problem are discussed, with particular emphasis on the need to cool milk to temp. below +4°C (or alternatively to temp. above +9°C). It is pointed out that unfortunately many coolers are designed for the range +4 to +9°C, at which pseudomonads grow very rapidly. 3 priorities for improving milk quality are indicated: maintaining the original bacterial balance in the milk; controlling Gram-negative bacteria and total bacterial counts; and paying for milk on the basis of total counts. Stress is also laid on the value of acid detergents and disinfectants for removing milk stone and thus controlling pseudomonad activity in milk-handling equipment. ADL

11

**Production of single cell protein.**

Mateles, R. I.; Goldberg, I.; Battat, E.

*United States Patent* 3 989 595 (1976) [En]

Process in which *Pseudomonas* sp., strain C is cultured in a medium containing 2.5-200 µg Cu, and, as a sole C source, methanol and formaldehyde, or methanol and formate. IFT

12

**[*Gluconobacter*, still drinks and plastics containers.]**

[Review]

Sand, F.

*Bios* 7 (10) 7-14 (1976) [72 ref. Fr, en] [Soc.

Naarden Int., Naarden Bussum, Netherlands]

*Gluconobacter*, formerly called *Acetomonas*, is a strictly aerobic, Gram-negative catalase-positive bacterium frequently responsible for off-flavours in some bottling plants. It is distinguished from acetic acid bacteria (*Acetobacter*) and *Pseudomonas* by a number of (tabulated) biochemical tests. It is resistant to the usual concn. of diethyldicarbonate (Baycovin R), benzoic acid and sorbic acid, to acidity (some strains grow at pH 2.4) and to heat. It is especially harmful to the stability of soft drinks in plastics containers containing large amounts of free  $O_2$ . To prevent contamination, strict plant hygiene and bottling under  $N_2$  is recommended. Membrane filters (pore size 0.6 µm) and glucose/yeast extract media are used to detect the organism. [From En summ.] RM



## 13

**Variability in *Xanthomonas vesicatoria* (Doidge) Dowson from tomato, chilli and datura.**

Mathew, J.; Patel, P. N.

*Current Science* 46 (1) 22 (1977) [4 ref. En]  
[Coll. of Agric., Vellayani, Kerala, India]

Eight isolates of *Xanthomonas vesicatoria* (3 from tomato, 4 from chilli, and 1 from datura) were examined for their morphological, biochemical, and physiological properties. It was concluded that these isolates represent 3 different strains, the strain from chilli probably being the original; the strain from tomato was somewhat more specific, while that from datura was the most specific of all, as it could not infect either tomato or chilli.

CFTRI

## 14

**Gelation of ultra-high-temperature-sterilized milk by proteases from a strain of *Pseudomonas fluorescens* isolated from raw milk.**

Law, B. A.; Andrews, A. T.; Sharpe, M. E.

*Journal of Dairy Research* 44 (1) 145-148 (1977)  
[13 ref. En] [Nat. Inst. for Res. in Dairying,  
Shinfield, Reading, RG2 9AT, UK]

Cooled raw milk was inoculated with approx.  $5 \times 10^4$  colony forming units (cfu) of *P. fluorescens* AR11/ml. Controls were left uninoculated. The samples were then either homogenized and immediately sterilized by heating at  $140^\circ\text{C}$  for 3.5 s or stored at  $7.5^\circ\text{C}$  for 1, 2 or 3 days before being processed in the same way. Milk sterilized immediately contained no viable bacteria whereas those samples held for 1, 2 and 3 days contained *P. fluorescens* AR11 at  $8 \times 10^5$ ,  $8 \times 10^6$  and  $5 \times 10^7$  cfu/ml respectively. UHT-sterilized milk samples in which AR11 had grown to  $5 \times 10^7$  and  $8 \times 10^6$  cfu/ml before sterilization gelled, as a result of protease activity, after 10-14 days and 8-10 wk respectively at  $20^\circ\text{C}$ . Uninoculated controls and milks which contained  $< 8 \times 10^6$  cfu of AR11/ml remained liquid for the full period of the experiment (20 wk). The numbers of bacteria used in this study were within the range found in stored commercial milk samples. The protease caused extensive protein breakdown of  $\kappa$ -casein to para- $\kappa$ -casein in a way similar to rennet action.  $\beta$ -casein was also broken down rapidly while  $\alpha_{s1}$ -casein was degraded only slowly. LMB

## 15

**Spoilage odors in poultry meat produced by pigmented and nonpigmented *Pseudomonas*.**

Cox, N. A.; Juven, B. J.; Thomson, J. E.; Mercuri, A. J.; Chew, V.

*Poultry Science* 54 (6) 2001-2006 (1975) [20 ref. En] [Anim. Products Utilization & Marketing Res. Lab., Richard B. Russell Agric. Res. Cent., USDA, Athens, Georgia 30604, USA]

20 isolates identified as *Pseudomonas* were obtained from spoiled poultry carcasses. 11 isolates were pigmented strains (*P. boreopulis*, *P. convexa*, *P. fairmontensis*, *P. synchyanea*) and the other 9

were nonpigmented (*P. fragi*). To determine whether there was a difference in the spoilage capabilities of pigmented and nonpigmented strains, each of the 20 organisms was inoculated into 4 different sterilized media: blended chicken breast meat and water; blended chicken skin and water; chicken bouillon (commercial); and nutrient broth in which poultry breast meat was substituted for beef extract. Incubation was at  $20^\circ\text{C}$  for 7 days or  $4^\circ\text{C}$  for 14 days. Experienced judges individually evaluated coded samples for intensity and character of odour at the end of each incubation period. Statistical analysis showed that there were no differences in mean odour scores among media, between incubation temp. or in the opinions of judges. However, difference between pigmented and nonpigmented strains was significant ( $p = .001$ ); the nonpigmented strains produced more intensive 'off' odours. AS

## 16

**[Manufacture of a *Xanthomonas* polysaccharide.] Verfahren zur Herstellung eines *Xanthomonas*-Polysaccharids.**Bechstedt, W.; Behrens, U.; Stolle, E.; Wagner, M.  
*German Democratic Republic Patent* 121 954 (1976) [De]

A process for manufacture of xanthans by aseptic aerobic fermentation is described, using a nitrate-metabolizing strain of *Xanthomonas campestris*. Advantages over use of strains requiring organic N include: ease of accurate metering of the required N concn., easy control of pH; reduced risk of infection (as organic N-requiring organisms cannot grow in the culture medium); and absence of undesirable residues of organic N sources in the product. IN

## 17

**Enumeration of temperature-stressed *Pseudomonas aeruginosa* utilizing selective procedures.**

Kukulinsky-Fuller, J. C.; Nelson, F. E.

*Journal of Food Science* 42 (2) 415-420 (1977)  
[25 ref. En] [Dep. of Nutr. & Food Sci., Univ. of Arizona, Tucson, Arizona 85721, USA]

Since food is a possible source of *Ps. aeruginosa* in hospital infections, the method of detection employed must be one which can be used with confidence. The purpose of this study was to determine effects of selective media and incubation temp. on enumeration of *Ps. aeruginosa* which had been subjected to temp. stress. Sublethally stressed cells were enumerated using the plate count procedure with Plate Count Agar (PCA) and several selective media. Exponential phase (5 h) cultures were stressed at  $1^\circ$  or  $5^\circ\text{C}$  in phosphate-buffered distilled water for 0, 5 and 30 min and 24 h. Counts on all media decreased as time of stress increased. Cold-stressed organisms plated on Acetamide Agar (ACE), King's Medium B with cetrimide (KMB), Trypticase Soy Agar with nitrofurantoin (TSN) and Naladixic Acid Cetrimide Agar (NAC) gave lower counts than PCA, but KMB and NAC were the only media that gave statistically different counts at the 95% confidence level. Stationary phase (24 h) cultures were stressed



at 55°C in reconstituted milk-SNF to obtain approx. 99% kill. Counts of heat-stressed organisms on ACE, KMB, TSN, NAC and Pseudosel BBL (PSE) were significantly lower than counts on PCA. Incubation of plates at 41°C reduced the count of heat-stressed cells significantly from counts obtained at 35° or 37°C on all media. Only PSE affected counts of unstressed organisms, counts being significantly lower than on PCA. Counts of temp.-stressed *Ps. aeruginosa* may be substantially decreased when selective procedures are used.  
IFT

## 18

[Growth of various Enterobacteriaceae, *Pseudomonas aeruginosa* and *Alkaligenes* sp. in distilled water, deionized water, tap water and mineral salt solutions.] Über die Vermehrung verschiedener Enterobacteriaceae sowie *Pseudomonas aeruginosa* und *Alkaligenes* spec. in destilliertem Wasser, entionisiertem Wasser, Leitungswasser und Mineralsalzlösung. Botzenhart, K.; Kufferath, R. *Zentralblatt fuer Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, IB* 163 (5/6) 470-485 (1976) [7 ref. De, en] [Hygiene-Inst., Univ. D-5300 Bonn-I, Federal Republic of Germany]

Studies on the ability of 12 strains of bacteria to survive and multiply in water and mineral salt solutions are described. The tap water samples were inoculated with the bacteria under investigation (at counts of 1000-27 000/ml); bacterial counts were determined at intervals during incubation of the inoculated samples for  $\leq 48$  days. Tables and graphs of results are given. The results show that *Serratia marcescans*, *Pseudomonas aeruginosa*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, *Citrobacter freundii*, *Erwinia* spp. and 2 strains of *Alkaligenes* were capable of growth in tap water; *Enterobacter cloacae* and *Hafnia alvei* remain at approx. the inoculated count, and *Providencia stuartii* and *Escherichia coli* are eliminated during the period studied. Possible implications for the hygienic quality of drinking water are discussed.  
AJDW

## 19

[*Gluconobacter*, still soft drinks and plastics containers.]  
Sand, F.

*Industrie delle Bevande* 6 (1) 77-82 (1977) [12 ref. It]

The need to differentiate between *Gluconobacter* (a strictly aerobic, Gram-negative, catalase-positive bacterium) and *Acetomonas* and *Pseudomonas* with regard to contamination problems in non-carbonated beverages, particularly when bottled in plastics containers, is stressed. Criteria for differentiation are tabulated, and the development of *Gluconobacter* in soft beverages is described. Use of an inert gas, e.g.  $N_2$ , is recommended during bottling to prevent growth of *Gluconobacter* organisms. HBr

## 20

Micro-organisms die while lipases survive.  
Hedlund, B.

*Nordeuropacisk Mejeri-Tidsskrift* 42 (7) 224-226 (1976) [En, Da, De] [Svenska Livsmedelinst., (SIK), Göteborg, Sweden]

Lipases from pseudomonads and micrococci, grown in skim-milk, were shown to have high heat stabilities. D values ranged from 51 and 9 min at 100°C to 1.25 and 1 min at 160°C for *Pseudomonas* and micrococcal lipases respectively. *Pseudomonas* lipase retained its original activity after 3 months storage at 4°C; when added to milk it was only 45% inactivated by heat treatment at 105°C for 10 min. Pasteurization inactivated most of the milk plasma lipase activity, but only partially inactivated the bacterial lipases formed in the milk during tank storage. The resistance of bacterial lipases to pasteurization treatment may result in fat hydrolysis occurring in certain stored foods, with a consequent loss of quality. MEG

## 21

[Taxonomic studies of aeromonads from milk, water and minced meat.] Taxonomische Untersuchungen an Aeromonaden aus Milch, Wasser und Hackfleisch.  
Kleeberger, A.

*Zeitschrift fuer Lebensmittel-Untersuchung und -Forschung* 163 (1) 44-47 (1977) [19 ref. De, en] [Bakt. Inst., Süddeutsche Versuchs- & Forschungsanstalt für Milchwirtschaft, Vöttinger Strasse 45, D-8050 Freising-Weißenstephan, Federal Republic of Germany]

## 22

[*Aeromonas* spp. and *Microbacterium* spp. in infant feeding formulae.]

Calcinardi, C.; Cantoni, C.; Aubert, D. d' *Atti della Società Italiana delle Scienze Veterinarie* 29, 563-565 (1975) [4 ref. It, fr, en] [Istituto di Ispezione degli Alimenti di Origine Animale, Univ. di Milano, Milan, Italy]

56 strains of bacteria were isolated from 10 samples of infant feeding formulae using the selective medium for Enterobacteriaceae recommended by Skovgaard [FSTA (1970) 2 7D533]. All the strains were identified as *Microbacterium* or *Aeromonas* spp. Therefore it is recommended that colonies growing on a selective medium for Enterobacteriaceae should be examined further for Gram coloration and by the oxidase test to eliminate some false positives.  
JMD

## 23

Properties and use of a new *Pseudomonas* peptidase. (In '5th International Fermentation Symposium' [see FSTA (1977) 9 8G557].)  
[Lecture]

Mälkki, Y.; Mattsson, R.; Rouhiainen, L.; Karaila, P.; Ilmonen, T.  
p. 367 (1976) [1 ref. En] [Helsinki Univ. of Tech., SF 02150 Espoo 15, Finland]



A strain of *Ps. fluorescens* (VTTE 8.7) originally isolated from soil produces a complex of endo- and exo-peptidases. The properties of these enzymes and their possible uses were examined. The main feature of the enzyme complex is the broad substrate specificity of the exo-peptidases. Hydrolysis of a co-precipitate of milk proteins and of pork fibrin are reported. The rate and extent of hydrolysis can be improved by combining the enzyme complex, either simultaneously or successively, with other proteases. The complex has a debittering action on peptides and its use in debittering Edam-type cheese is discussed. JA

## 24

**Vinegar production in continuous surface fermentation.** (In '5th International Fermentation Symposium' [see FSTA (1977) 9 8G557].) [Lecture]

Mori, A.; Suneya, Y.; Yasui, Y.  
p. 361 (1976) [En] [Kewpie Jyozo Co. Ltd., Fuchu, Tokyo, Japan]

The construction and operation of a continuous surface fermentation system for vinegar production are described with the aid of diagrams, and tests carried out with the system are briefly reported. The method involves cultivation of *Acetobacter aceti* on a medium of fermented wort supplemented with alcohol and vinegar. A continuous concn. analyser was developed and used for measuring changes in alcohol concn. Feed rate was regulated, in response to alcohol concn., by an electromotive value. Temp. of the fermenting medium was 33-38°C and the fermentation cycle time was generally 22.45 h. JA

## 25

**Production of L-serine by the methanol utilizing bacterium, *Pseudomonas 3ab*.**

Keune, H.; Sahm, H.; Wagner, F.

*European Journal of Applied Microbiology* 2 (3) 175-184 (1976) [29 ref. En] [Lehrstuhl für Biochemie & Biotech., Tech. Univ. Braunschweig, D-3300 Braunschweig-Stockheim, Federal Republic of Germany]

A bacterium capable of growth on methanol and some organic acids as sole source of C and energy has been isolated and designated *Pseudomonas 3ab*. This facultative methylotrophic organism apparently utilizes the serine pathway of formaldehyde fixation. When methanol was used as the sole C source for growth, L-serine production by *Pseudomonas 3ab* occurred upon the addition of glycine and methanol at the end of the exponential growth phase. The max. yield of L-serine (4.7 g/l.) was obtained when 20 g/l. glycine and 8 g/l. methanol were added and the pH of the culture medium was changed to 8.5. Although *Pseudomonas 3ab* is unable to grow on L-serine or glycine, it is very active in decomposing these amino acids. The degradation of L-serine and glycine has been shown to be pH-dependent with a min. at pH 8.5-9.0. AS

## 26

**Nitrite inhibition of active transport and of respiration in *Pseudomonas aeruginosa*.**

Rowe, J. J.; Hodge, T. W., III; Eagon, R. G.  
*Abstracts of the Annual Meeting of the American Society for Microbiology* 77, 223 (1977) [En] [Univ. of Georgia, Athens, Georgia, USA]

Nitrite is often incorporated in food products to enhance colour and to prevent bacterial growth. The mechanism of the inhibitory action of nitrite on bacterial systems is obscure. During studies on active transport of radioactive solutes by *Pseudomonas aeruginosa* using nitrogen oxides as terminal electron acceptors, it was observed that nitrite dramatically inhibited active transport at a concn. of  $\geq 50$  mM. Active transport of glucose and of gluconate in *P. aeruginosa* was inhibited 95% by 100mM nitrite; but nitrite had no effect on the transport of glucose in *Streptococcus faecalis*, an organism lacking cytochromes. Measurement of  $O_2$  uptake by suspensions of cells of *P. aeruginosa* in the presence and absence of nitrite revealed that respiration was also inhibited by nitrite. From these data it is postulated that nitrite inhibited active transport in *P. aeruginosa* by inhibiting electron flow which is required to energize active transport. AS

## 27

**[Physiological and biochemical parameters in the selection of automated methods for monitoring processes in microbiological synthesis.]**

Rylkin, S. S.; Samoilenko, V. A.; Gurina, L. V.; Vinogradov, B. D.; Chigaleichik, A. G.; Orlova, B. S.

*Prikladnaya Biokhimiya i Mikrobiologiya* 12 (6) 834-838 (1976) [21 ref. Ru, en] [Inst. Biochem. & Physiol. of Microorganisms, USSR Acad. Sci., Pushchino, USSR]

Changes in the biomass of the yeast *Candida tropicalis* IBPM Y-303, activities of deamidases of asparagine and glutamine from *Pseudomonas boreopolis* 526 and morphological characteristics of the population with respect to the specific growth rate were examined. Correlations between physiological-biochemical characteristics of the population and cell morphology were established. AS

## 28

**[Microbial protein.]**

Japan, Tokyo University

*Japanese Patent* 5 140 137 (1976) [Ja]

A strain of *Pseudomonas aeruginosa* is aerobically cultivated and the resulting microbial protein separated by physicochemical means. IFT

## 29

**Production of microorganisms.**

Sheli Internationale Research Maatschappij BV  
*British Patent* 1 461 575 (1977) [En]

A microbial protein food is obtained by the aerobic cultivation in a methanol medium of a non-pink-pigmented strain of *Pseudomonas extorquens*. IFT

## 30

[Effect of a *Lactobacillus* starter culture in vacuum-packaged meat on *Salmonella* and *Pseudomonas* organisms.]

Tezcan, I.; Yücel, A.

*Veteriner Hekimler Dernegi Dergisi* 45 (4) 7-10 (1975) [5 ref. Tr, en] [Vet. Fac., Univ., Ankara, Turkey]

Buttermilk with a high content of lactobacilli was added before vacuum packaging to 3 samples comprising portions of leg of beef, (i) alone, (ii) + *Salmonella* spp., (iii) + *Pseudomonas fluorescens*. Beef samples without buttermilk were used as controls. The samples were examined after storage for 2, 4 and 6 wk at +4°C. The addition of buttermilk resulted in a slight increase in tenderness, but the meat developed an acid flavour. The buttermilk inhibited growth of *Salmonella* and *Pseudomonas* spp. ADL

## 31

Growth of psychrotrophic bacteria alters stability of milk to coagulation by rennet and heat. [Lecture]

Cousin, M. A.; Marth, E. H.

*Journal of Dairy Science* 60 (suppl. 1) 34 (1977) [En] [Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

Raw and pasteurized milks inoculated with psychrotrophs coagulated more rapidly than control milk. Pasteurized milk inoculated with a *Pseudomonas* sp. was unstable to heat after 6 days at 7°C. [See FSTA (1977) 9 11P1719.] MEG

## 32

A short note on *Aeromonas* strains isolated from market goat meat and its public health importance.

Kumar Sinha, B.; Mandal, L. N.; Sinha, B. K.

*Science and Culture* 43 (4) 186-187 (1977) [5 ref. En] [Bihar Vet. College, Patna 800 014, India]

Ten strains belonging to *Aeromonas formicans* and *Aeromonas liquefaciens* were recovered from the liver, spleen and mesenteric lymph nodes of goat carcasses. They were not found in samples of goat muscle. Some of the physiological and biochemical characteristics of these microbes are reported. If they happen to survive the heat treatment during cooking, they can cause gastroenteritis, choleraic diarrhoea or urinary tract infections in human beings. CFTRI

## 33

The protective effect of fat on the heat resistance of bacteria. I.

Senhaji, A. F.; Loncin, M.

*Journal of Food Technology* 12 (3) 203-216 (1977) [28 ref. En] [Sect. de Tech. Alimentaire, Inst. Agron & Vet. Hassan II, BP 704, Rabat-Agdal, Morocco]

The effect of several oil/water systems (soybean oil in each case) on the heat resistance of spores of *Bacillus subtilis* and vegetative cells of *Pseudomonas fluorescens* was investigated. Decimal

reduction times are tabulated and survival curves are presented. Heat resistance was higher in the presence of oil and greatest without added water. An explanation of the phenomena observed is suggested in terms of differences in water activity between the systems. [See also following abstr.] AS

## 34

[Hygienic importance of proteolytic organisms.]

Hruby, S.; Maresova, P.; Zezulkova, M.

*Prumysl Potravin* 28 (4) 225-228 (1977) [10 ref. Cs] [Inst. Hygieny a Epidemiologie, Prague, Czechoslovakia]

The capacity of strains of *Bacillus*, *Pseudomonas* and *Proteus* spp. to hydrolyse gelatin and casein in solid media was studied. Of 40 *Bacillus* strains, 62.5% showed strong proteolytic activity, *B. subtilis*, *B. pumilus*, *B. megaterium* and *B. cereus* and their intermediary strains being particularly active. Of 41 *Pseudomonas* strains, only 19.5% were very strongly proteolytic, whilst all 4 *Proteus vulgaris* strains tested were very strongly proteolytic. The strains of the 4 *Bacillus* spp. and their intermediaries were also very strongly proteolytic in milk, hydrolysing both native and denatured proteins and releasing ammonia. FL



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FAB 43

PSEUDOMONADACEAE AND FOOD PROCESSING

SELECTED FROM VOLUME 10  
FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

under the direction of

Commonwealth Agricultural Bureaux, Farnham Royal, Bucks; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublikaties en Landbouwdocumentatie (Pudoc), Wageningen.



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H. BROOKES

ASSISTANT EDITOR





## 1

[Aeromonads in foods and their possible role as causative organisms in food poisoning.]

Kalina, G. P.

*Gigiena i Sanitariya* No. 8, 97-100 (1977) [14 ref. Ru] [Moskovskii Nauchno-issled. Inst. Gigeny im. F. F. Erismana, Moscow, USSR]

Preliminary tests with fish, milk and drinking water confirmed literature findings that aeromonads can be implicated in outbreaks of food poisoning. The increased heat tolerance of aeromonads isolated from food poisoning cases is indicated. HBr

## 2

**Evaluation of the protein quality of single-cell protein produced from mesquite.**

Yang, H. H.; Yang, S. P.; Thayer, D. W.

*Journal of Food Science* 42 (5) 1247-1250 (1977) [26 ref. En] [Dep. of Food & Nutr., Texas Tech. Univ., Lubbock, Texas 79409, USA]

Cells of *Pseudomonas* JM127 were grown in a medium containing mesquite wood as the sole source of C. The nutritional value of the microbial protein thus produced was determined. The essential amino acid composition of the microbial protein is tabulated. The protein contained more lysine and methionine than the FAO/WHO amino acid pattern and the requirement of infant, child or adult. The net protein utilization measurements indicated that the biological value of protein in the intact single cells was inferior to that of casein. The net protein utilization and N digestibility were significantly improved when the cells were mechanically homogenized. IFT

## 3

**Effect of *Pseudomonas fragi* on the color of beef.**

Bala, K.; Marshall, R. T.; Stringer, W. C.;

Naumann, H. D.

*Journal of Food Science* 42 (5) 1176-1179 (1977) [30 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Missouri, Columbia, Missouri 65201, USA]

Growth of *Pseudomonas fragi* had a significant ( $P < 0.05$ ) effect on the colour of beef stored at  $1 \pm 1^\circ\text{C}$ . Beef colour was measured with a Hunter Colour/Difference Meter and % of myoglobin, oxymyoglobin ( $\text{O}_2\text{Mb}$ ), and metmyoglobin on meat surfaces were determined using a Beckman DU Spectrophotometer with a reflectance attachment. As surface growth of *P. fragi* increased from log 2.2 to log 7.2/cm<sup>2</sup> during 20 days storage at  $1 \pm 1^\circ\text{C}$ , the pH increased from 5.5 to 6.6, free fatty acid values increased from 0.62 to 2.60 and %  $\text{O}_2\text{Mb}$  decreased from 100% to 0%. Data indicated that proteolytic and lipolytic degradation products of *P. fragi* may be important in decreasing the colour stability of beef stored at  $1 \pm 1^\circ\text{C}$ . IFT

## 4

**Thermostability at ultrahigh temperatures of thermolysin and a protease from a psychrotrophic *Pseudomonas*.**

Barach, J. T.; Adams, D. M.

*Biochimica et Biophysica Acta* 485 (2) 417-423

(1977) [19 ref. En] [Dep. of Food Sci., N. Carolina State Univ., Raleigh, N. Carolina 27607, USA]

Thermal inactivation at  $110\text{--}150^\circ\text{C}$  of thermolysin (EC 3.4.24.4), produced by the thermophile *Bacillus thermoproteolyticus*, and the extracellular protease of *Pseudomonas* sp. MC60 a psychrotroph, were investigated at  $130^\circ\text{C}$ . Both enzymes had approx. the same  $\Delta H$  (22 kcal/mol) and  $\Delta S$  (-13.5 cal/mol per degree) values. Both enzymes contain Zn and Ca. The amino acid compositions of the enzymes were similar except that MC60 protease exhibited a more typical tyrosine content. Comparable heat resistance at extreme temp. of enzyme produced by psychrotrophic and thermophilic organisms emphasizes the difference between molecular properties that resist denaturation at elevated temp. and those that allow reversible denaturation. AS

## 5

**Some properties of the extracellular protease produced by the psychrotrophic bacterium *Pseudomonas fluorescens* strain AR-11.**

Alichanidis, E.; Andrews, A. T.

*Biochimica et Biophysica Acta* 485 (2) 424-433

(1977) [14 ref. En] [Nat. Inst. for Res. in Dairying, Shinfield, Reading RG2 9AT, UK]

The major extracellular protease from *Pseudomonas fluorescens* strain AR-11 has been partially purified by a combination of DEAE-cellulose ion-exchange chromatography and gel filtration. The enzyme had a mol. wt. of 38 400 and exhibited optimum activity with isoelectrically precipitated casein substrate at pH 6.5 with  $K_m = 0.13\text{mM}$ . The protease was strongly inhibited by a number of heavy metal ions at the 10mM level and also inhibited by thiol agents, while 10mM EDTA led to slight activation. Optimum activity was exhibited at an incubation temp. of about  $35^\circ\text{C}$ ; above  $37^\circ\text{C}$  the enzyme was rapidly inactivated, but at low temp. considerable activity was retained, amounting to 33% of the max. activity at  $4^\circ\text{C}$  and 72% at  $20^\circ\text{C}$ . Heat inactivation studies in which the isolated protease was heated at high temp. before subsequent incubation at  $35^\circ\text{C}$  with substrate showed that for 50% inactivation 25 s heating at  $130^\circ\text{C}$  or 17 s at  $140^\circ\text{C}$  or 8.5 s at  $150^\circ\text{C}$  was required. The combination of high stability to heat treatments and retention of considerable activity at low incubation temp. indicates that such a protease might have considerable significance in the processing and subsequent storage of food and other products. [See FSTA (1977) 9 6P973.] AS



## 6

Effect of conventional and microwave heating on *Pseudomonas putrefaciens*, *Streptococcus faecalis* and *Lactobacillus plantarum* in meat tissue.

Crespo, F. L.; Ockerman, H. W.; Irvin, K. M. *Journal of Food Protection* 40 (9) 588-591 (1977) [24 ref. En] [Anim. Sci. Dep., Ohio State Univ., Columbus, Ohio 43210, USA]

Conventional cooking in an oven at  $176 \pm 6^\circ\text{C}$  proved to be more destructive than microwave cooking when individual strains of *P. putrefaciens*, *L. plantarum*, and *S. faecalis* were inoculated and grown in aseptically obtained meat tissue and then heated and compared at similar final internal temp. *P. putrefaciens* was the most heat sensitive microorganism in both cooking techniques. *S. faecalis* was the most heat resistant strain when cooked by conventional means but *L. plantarum* proved to be the most resistant when heat was applied by microwave energy. AS

## 7

Development of *Yersinia enterocolitica*-like organisms in pure and mixed cultures on different bismuth sulfite agars.

Hanna, M. O.; Stewart, J. C.; Carpenter, Z. L.; Vanderzant, C.

*Journal of Food Protection* 40 (10) 676-677 (1977) [2 ref. En] [Anim. Sci. Dep., Texas Agric. Exp. Sta., College Station, Texas 77843, USA]

*Yersinia enterocolitica*-like isolates from meats produced black colonies on 8 of 9 lots of bismuth sulphite agar. Differences were observed in size and black metallic sheen of colonies on different lots of this medium. In addition, inhibition of *Pseudomonas* spp. differed among lots. AS

## 8

Use of canonical variates analysis in differentiation of bacteria by pyrolysis gas liquid chromatography.

Macfie, H. J. H.; Gutteridge, C. S.; Norris, J. R. *Journal of General Microbiology* 104 (1) 67-74 (1978) [22 ref. En] [Agric. Res. Council, Meat Res. Inst., Langford, Bristol, Avon BS18 7DY, UK]

Low-resolution pyrolysis gas-liquid chromatography (PGLC) can differentiate genera of aerobic food spoilage bacteria including *Lactobacillus* and *Pseudomonas* spp. Multivariate statistical techniques were applied, but neither principal components nor furthest neighbour cluster analysis produced a consistent differentiation although both confirmed the reproducibility of PGLC. When the distance between genera was redefined in terms of Mahalanobis  $D^2$  - a generalized concept taking into account scatter around the mean - good differentiation was observed and could be displayed graphically by plotting the genus group means relative to the first two canonical variate axes. The coeff. of the canonical variates provide a strategy for discriminating between the genus groups. Some practical problems in the identification of unknowns using this technique are discussed. AS

## 9

Changes of color of aqueous beef extract caused by *Pseudomonas fragi*.

Bala, K.; Marshall, R. T.; Stringer, W. C.; Naumann, H. D.

*Journal of Food Protection* 40 (12) 824-827 (1977) [25 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Missouri, Columbia, Missouri 65201, USA]

The significance of *P. fragi* in microbial meat discoloration was investigated. Growth of *P. fragi* had a significant ( $P < 0.05$ ) effect on the colour of aqueous beef extract stored at  $1 \pm 1^\circ\text{C}$ . As numbers of *P. fragi* increased from log 5 to log 7.9/ml during 10 days of storage at  $1 \pm 1^\circ\text{C}$ , the pH increased from 5.5 to 6.0. At the end of 10 days there was a 76% loss of oxymyoglobin in samples inoculated with *P. fragi*. There was a 45% loss of oxymyoglobin in sterile-control samples. A possible mechanism for conversion of oxymyoglobin to metmyoglobin is suggested. AS

## 10

Procedure for the isolation of lipases produced by *Pseudomonas* species and *Achromobacter lipolyticus*.

Scholefield, J.; O'Donnell, E. T.; Davies, G. *Journal of Food Technology* 13 (2) 129-136 (1978) [19 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Strathclyde, Glasgow C1, UK]

The extracellular lipase systems from 3 *Pseudomonas* spp. and a strain of *Achromobacter lipolyticus* were concentrated and partially purified using a DDS plate-and-frame ultrafiltration unit. Recoveries of 75-97% were reported for the pseudomonad enzyme systems with increases in specific activity of 18-40 times. The low yields obtained for *A. lipolyticus* preparations were concluded to be due to the loss of a loosely bound ion or low mol. wt. compound necessary for optimum activity. AS

## 11

*Gluconobacter*, still drinks and plastic containers.

Sand, F. E. M. J. *Soft Drinks Trade Journal* 31 (10) 371-373 (1977) [10 ref. En] [Naarden Int., Naarden-Bussum, Netherlands]

*Gluconobacter* in still drinks is discussed under the following headings: the bacterial flora of soft drinks; nutrient media for the cultivation of *Gluconobacter*; growth in soft drinks; epidemiology and ecology; and how to fight *Gluconobacter*. SP

## 12

Effect of heat treatments on survival and growth of a psychrotroph and on nitrogen fractions in milk.

Weckbach, L. S.; Langlois, B. E. *Journal of Food Protection* 40 (12) 857-862 (1977) [18 ref. En] [Dep. of Anim. Sci., Univ. of Kentucky, Lexington, Kentucky 40506, USA]

Grade A raw milk which had initial psychrotrophic counts of  $< 10^3/\text{ml}$  was inoculated



with an antibiotic-resistant *Pseudomonas* sp. to a final cell concn. of  $10^2$ ,  $10^4$ , or  $10^6$ /ml. The inoculated milk was held at 4°C for 14 h and then exposed to the following time-temp. treatments: 72°C for 15 s, 79°C for 15 s, 88°C for 10 s, or 95°C for <5 s. An uninoculated raw milk control was handled and analysed along with inoculated samples. Aliquots of milk were analysed for marked *Pseudomonas* sp., total psychrotrophic counts, numbers of *Pseudomonas*, and for N distribution before and after each heat treatment and after storage of non-heat-treated raw milk and heat-treated samples for 7 and 14 days at 7°C. Psychrotrophic counts were significantly affected by heat treatment, initial cell inoculum, days stored, and plating media. Non-casein N, non-casein protein, total albumin,  $\beta$ -lactoglobulin, proteose-peptone, and globulin N were significantly decreased by heat treatment. Non-casein N, non-casein protein,  $\beta$ -lactoglobulin, and proteose-peptone were significantly increased by days of storage. AS

### 13

**Influence of the predominance of certain psychrotrophic bacteria on reduction tests on raw milk.**

Caruso, N. S.; Feder, A.

*XX International Dairy Congress* E, 186-187 (1978) [6 ref. En] [Catedra de Tecnologia de la Leche. Inst. de Ind. Alimentaria, Alberto Lasplacés 1550, Montevideo, Uruguay]

Results of methylene blue and triphenyltetrazolium chloride reduction tests are discussed in relation to psychrotrophic bacterial counts determined for 180 can milk samples. Of the psychrotrophic flora, 73.3% was *Pseudomonas* spp. [See FSTA (1978) 10 10P1408.] ADL

### 14

**Production and heat stability in milk of proteinases and lipases of psychrotrophic pseudomonads.**

Te Whaiti, I. E.; Fryer, T. F.

*XX International Dairy Congress* E, 303-304 (1978) [2 ref. En] [New Zealand Dairy Res. Inst., Palmerston North, New Zealand]

Proteinase production by 2 *Pseudomonas* strains was low at refrigeration temp., and  $\leq 5\%$  max. activity was exhibited at 10°C; the enzymes were fairly stable to heating at 130°C for 20 s. Lipase production was less affected by growth temp., and  $> 20\%$  max. activity was obtained at 10°C, production of both constitutive and inducible lipases being indicated. [See FSTA (1978) 10 10P1408.] CDP

### 15

**Basic factors affecting the microflora and quality of kefir.**

Koroleva, N. S.; Rozhkova, I. V.; Bavina, N. A. *XX International Dairy Congress* E, 843 (1978) [En] [All-Union Inst. of Dairy Ind., Moscow, USSR]

The microflora and quality of kefir were affected by the season and, mainly, by the type of culture used. In tests investigating the effect of different levels of culture addition (1-5%), no significant differences were noted in the duration of fermentation and the microflora of the finished product. Increased numbers of acetic acid bacteria in kefir were associated with some improvement in its consistency. Reducing the amount of kefir fungi in the culture improved the taste of kefir. [See FSTA (1978) 10 10P1408.] FL

### 16

**Effect of heat resistant lipases on changes in milk fat in UHT-treated milk.**

Hladik, J.; Dolezalek, J.; Synkova, J.

*XX International Dairy Congress* E, 276-277 (1978) [En] [Inst. of Chem. Tech., Prague, Czechoslovakia]

Enzymes isolated from *Pseudomonas fluorescens* produced marked lipolysis in UHT milk during 3 wk storage; lipolysis by the enzyme from *Ps. putrefaciens* was less pronounced. Residual lipolytic activity of the enzymes after treatment at 120°C for 2 min was about 5%. Results indicated a possibility of lipolytic changes occurring in UHT milk as a result of increases in *Pseudomonas* spp. in the milk prior to heat treatment. [See FSTA (1978) 10 10P1408.] CDP

### 17

**Heat resistance of *Pseudomonas* lipases in milk.**

Knaut, T.

*XX International Dairy Congress* E, 305 (1978) [8 ref. En] [Inst. of Food Eng. & Biotech., Tech. Univ. of Agric., Olsztyn, Poland]

Lipase activity was detected in cultures of *Pseudomonas fluorescens* 95, grown for 7 days in skim-milk at 18°C, and heated at 63.5°C for 30 min, and in *Ps. fluorescens* R3 grown for 6 days at 18°C and heated at 80°C for 10 min. Heat-stable lipolytic activity was also found in a culture of *Achromobacter* sp. 1447 grown for 6 days in skim-milk and heated at 95°C for 10 min. [See FSTA (1978) 10 10P1408.] MEG

### 18

**Detection, incidence and significance of *Pseudomonas aeruginosa* in raw milk and in the environment of dairy cows.**

Otte, I.; Hahn, G.; Tolle, A.

*XX International Dairy Congress* E, 93-94 (1978) [6 ref. En] [Fed. Dairy Res. Cent., Kiel, Federal Republic of Germany]

Methods are described for isolating and identifying *Ps. aeruginosa*. On 5 dairy farms the average isolation frequency was 34.7% for 927 bulk and can milk samples, 5.4% for milk from 147 individual cows, 4% for 124 quarter milk samples and 1% for teat surfaces. *Ps. aeruginosa* was detected in drinking water, milking equipment and walls and floor of the barn; 12.5% of milkers had *Ps. aeruginosa* on their hands. [See FSTA (1978) 10 10P1408.] MEG

## 19

**Production and characterization of lipase from a fluorescent pseudomonad.**

Landaas, A.; Solberg, P.

*XX International Dairy Congress E*, 305-305

(1978) [3 ref. En] [Dairy Res. Inst., Agric. Univ. of Norway, As-NLH, Norway]

Lipase of *Pseudomonas fluorescens*, active over a broad temp. and pH range, showed activity at 1°C that was >30% of max. activity. Relatively greater amounts of short-chain fatty acids were liberated at 5°C than at 10-30°C. Absence of SH-groups in the active site of the lipase was indicated. [See FSTA (1978) 10 10P1408.] CDP

renneted gels were cut at the same modulus. Cleavage of linkages in the casein gel network by proteases from the *Pseudomonas* sp. would account for the higher water holding capacity and lower max. rigidity modulus of the gels. [See FSTA (1978) 10 10P1408.] MEG

## 20

**Use of ultrafiltration for the purification of microbial lipases.**

O'Donnell, E. T.; Davies, G.

*XX International Dairy Congress E*, 298-299

(1978) [1 ref. En] [West. of Scotland Agric. Coll., Ayr, UK]

Extracellular lipases, produced by *Pseudomonas* spp. grown at 5°C, were concentrated from the culture medium by ultrafiltration. The desalted concentrate can be freeze-dried to give a product with high lipase activity. [See FSTA (1978) 10 10P1408.] MEG

## 21

**Studies on single cell protein production from sugar containing effluents.**

Camhi, J. D.

*Dissertation Abstracts International, B* 37 (7)

3213 (1977) [En] [Univ. of New South Wales, POB 1, Kensington 2033, NSW, Australia]

*Candida utilis* and *Pseudomonas denitrificans* were cultured on sulphite liquor waste (SLW) to study possibility of pollution reduction and production of single cell protein (SCP). Single- and 2-stage culture of *C. utilis* was studied; optimum biomass output was obtained using 1 vessel with partial recycle. Max. growth rates were at pH 5.0 and 30°C. *P. denitrificans* was grown on the yeast culture supernatant; this organism utilized mainly aromatic compounds and approx. 18% of the lignin in SLW. Final BOD content after yeast and bacterial growth was 3000 p.p.m. Amino acid profiles and protein contents of the 2 organisms showed that the method was potentially useful for production of SCP and reduction of pollution caused by SLW. DIH

## 22

**Effects of *Pseudomonas* species on the syneresis of renneted milk gels.**

Lelievre, J.; Kelso, E. A.; Stewart, D. B.

*XX International Dairy Congress E*, 760-762

(1978) [2 ref. En] [Fac. of Agric. & Food Sci., Queens Univ., Belfast, UK]

Aseptically obtained milk, inoculated with a *Pseudomonas* sp. and incubated for 5 or 6 days at 5°C, released less whey than control milk when the



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FAB 43

PSEUDOMONADACEAE AND FOOD PROCESSING

SELECTED FROM VOLUME **13**  
FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

under the direction of:-

Commonwealth Agricultural Bureaux, Farnham Royal, Slough; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublikaties en Landbouwdocumentatie (Pudoc), Wageningen.



## INTRODUCTION

Food Annotated Bibliographies (FABs) are collections of abstracts on specific topics in food science and technology. The topics are chosen by the staff of the International Food Information Service as being of particular interest or importance. The topics normally interest individual workers, who may not require the full information provided in Food Science and Technology Abstracts, from which the abstracts for FABs are taken. The size and the cost of the FABs are controlled as much as possible with the interests of individual workers in mind.

Titles of the FABs now available are given on the back cover of this booklet. For up-to-date lists of FABs or suggestions for new topics please write to the address on the back cover. New subjects are searched for at least the five most recent volumes of Food Science and Technology Abstracts. Thereafter each FAB is updated monthly. Copies of each month's abstracts on any topic may be obtained as indicated on the back cover of this publication. At the end of each volume of up-dating, the abstracts are merged and made available as a separate supplement to the original FAB.

Some of the larger FABs have been divided into sections to facilitate use. FAB 47 also has a subject and author index provided.

Copies of all original articles referred to in the abstracts may be bought ( or occasionally borrowed) from the International Food Information Service. A form for ordering these is provided at the end of this FAB.

Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES

EDITOR





1

**Utilization of methane (natural gas) in the production of single cell protein (SCP). I. Studies on the isolation and characterization of methane utilizing bacteria.**

Erfan Ali, M.; Nurul Huq, M.; Chowdhury, M.  
*Bangladesh Journal of Scientific and Industrial Research* 14 (1/2) 219-224 (1979) [10 ref. En] [BCSIR Lab., Dacca, Bangladesh]

In studies of natural gas as a potential substrate for SCP production for human and animal nutrition, bacterial strains were isolated from soil in gas fields, sewer and garden samples. 8 cultures were isolated using methane and methanol as sole C and energy source. All the organisms were Gram-negative, strictly aerobic and classifiable into 3 groups by morphology, pigment and slime formation. They were identified as strains of *Pseudomonas methanica*. Methods of isolation, culture and some properties are described. [From En summ.] RM

2

**[Acetic acid bacteria in the brewery.] Die Essigsäurebakterien in der Brauerei. [Lecture]**  
Pioss, M.; Erber, J.; Eschenbecher, F.  
*Proceedings, European Brewery Convention* pp. 521-532 (1979) [12 ref. De, en, fr] [Tech. Univ. München, Freising-Weihenstephan, Federal Republic of Germany]

In a detailed investigation, strain relationships, frequency and distribution of acetic acid bacteria in the brewery are discussed first. 1203 samples of barley, malt, hops, wort, yeast, beer together with samples taken along the pathway of brewing production from the fermentation cellar to filling and in the air in a brewery were examined for acetic acid bacteria. From the 153 positive samples, 465 strains were isolated. Identification of these strains revealed that both genera of acetic acid bacteria, *Acetobacter* and *Gluconobacter*, are encountered in the brewery. Of the 3 spp. of *Acetobacter*, 2 namely *A. pasteurianus* and *A. aceti* were represented but *A. peroxydans* was not found. *A. pasteurianus* subsp. *pasteurianus* dominated (69.7%) whilst the usual minor strains of this sp. and the types of *A. aceti* together accounted for < 10%. The 2nd most frequently present organisms were the polar-flagellated *Gluconobacter oxydans* (21.1%). No acetic acid bacteria were found on barley and hops whilst the number of malt, wort, yeast and air samples found to be infected with such microorganisms was relatively small. Filtration and filling samples were highly infected as were most storage vessels, pressure-equilibration and stability samples. The frequent presence of acetic acid bacteria in filled beer clearly indicates that more care should be taken during filling so that no inappropriate high O<sub>2</sub> contents therein facilitate the formation of a slight haze by the underrated acetic acid bacteria frequently described as 'only potential' beer-spoilage microorganisms. [See FSTA (1981) 13 1H6.] AS

3

**Growth of *Aeromonas hydrophila* at low concentrations of substrates added to tap water.**  
Kooij, D. van der; Visser, A.; Hijnen, W. A. M.

*Applied and Environmental Microbiology* 39 (6) 1198-1204 (1980) [29 ref. En] [Netherlands Waterworks Testing & Res. Inst, KIWA Ltd., 2280 AB Rijswijk, Netherlands]

Representatives of the spp. *Aeromonas hydrophila* have frequently been observed in tap water. Their presence is undesirable as they interfere with the detn. of coliform bacteria, and *A. hydrophila* is known to be an opportunistic pathogen for humans. Growth of *A. hydrophila* strain 315 at 15°C in the presence of low concn. of substrates added to tap water was determined. D-glucose caused growth even at initial concn. of < 10 µg of C/l. The use of starch at low concn. was also studied: at initial concn. below the K<sub>s</sub> value (substrate concn. which produces half the max. growth rate) of starch (73 µg of C/l) no growth was observed, but after the addition of 10 µg of glucose-C/l complete use of starch occurred. The isolate studied may be used in growth experiments to assess the max. concn. of glucose in water, particularly tap water. AL

4

**Effect of high concentrations of carbon dioxide on growth rate of *Pseudomonas fragi*, *Bacillus cereus* and *Streptococcus cremoris*.**

Enfors, S. O.; Molin, G.  
*Journal of Applied Bacteriology* 48 (3) 409-416 (1980) [17 ref. En] [Tech. Microbiol., Chemical Cent., S-220 07 Lund, Sweden]

Max. specific growth rates of *Ps. fragi*, *B. cereus* and *Strep. cremoris* were studied over a wide range of CO<sub>2</sub> concn. Growth rate, compared with a control, was reduced to 50% in *Ps. fragi* at 0.5 atm CO<sub>2</sub> in *B. cereus* at 1.3 atm and in *Strep. cremoris* at 8.6 atm. *B. cereus* and *Strep. cremoris* were completely inhibited at 3 and 11 atm CO<sub>2</sub>, resp. Growth rate of the aerobic *Ps. fragi* at 0.99 atm CO<sub>2</sub> (0.01 atm O<sub>2</sub>) was reduced to about 20% of that in air. Growth rate of *Ps. fragi* was decreased at O<sub>2</sub> concn. < 0.01 atm. When *Ps. fragi* was grown at O<sub>2</sub> limitation (0.0025 atm O<sub>2</sub>) and exposed to 0.99 atm CO<sub>2</sub>, the inhibiting effect of the CO<sub>2</sub> was added to that of the O<sub>2</sub> limitation. No indications of a synergistic effect between CO<sub>2</sub> inhibition and O<sub>2</sub> limitation were noted. *B. cereus* and *Strep. cremoris* were tested under anaerobic conditions. AS

5

**Contaminated hospital water supplies.**

Black, H. J.; Holt, E. J.; Kitson, K.; Maloney, M. H.; Philipps, D.  
*British Medical Journal* 1 (6177) 1564-1565 (1979) [En] [Royal Infirmary, Huddersfield, W. Yorks HD3 3EA, UK]

Attention is drawn to the risk of contamination of domestic water supplies used in hospitals, and examples of how this has happened in the past are cited, involving mainly *Pseudomonas* infection. It is recommended that hospital water supplies should be monitored microbiologically and that hospital hot water for domestic purposes should be kept at a temp. high enough to kill vegetative bacteria. LH



[Milk proteinases. IX. Proteolytic activity profiles of casein micelles, milk serum, bovine blood serum and *Pseudomonas fluorescens*.] Milchproteinasen. IX. Proteinasespektren von Caseinmicellen, Milchserum, Rinderblutserum und *Pseudomonas fluorescens*. Reimerdes, E. H.; Petersen, F.; Kielwein, G. *Milchwissenschaft* 34 (9) 548-551 (1979) [29 ref. De, en] [Bundesanstalt für Milchwissenschaft, Kiel, Federal Republic of Germany]

The composition and characteristics of the proteinase complexes (i) prepared by acid extraction and  $(\text{NH}_4)_2\text{SO}_4$  precipitation from casein micelles (obtained by ultracentrifugation in milk at up to  $300\,000 \times g$ , for 120 min at  $20^\circ\text{C}$ ), (ii) of milk serum (decanted from the micelle layer and filtered), (iii) of serum separated from subcutaneous abdominal vein blood of lactating cows, and (iv) of cell-free culture medium of *P. fluorescens* were determined by measuring extent of proteolysis of each on 11 substrates consisting of the 4-nitroanilides of glycine, L-alanine, L-leucine, L-phenylalanine, L-tyrosine, L-lysine, N-acetyl-L-alanine, glutaryl-L-phenylalanine, N-acetyl-L-tyrosine, N- $\alpha$ -benzoyl-DL-lysine, and N- $\alpha$ -benzoyl-DL-arginine. (i) enzymes showed typical trypsin-like activities, hydrolysing mainly lysyl and arginyl peptide bonds; (ii) enzymes showed aminopeptidase activity, especially for alanyl, leucyl and lysyl bonds; the pattern was outstandingly similar to that of blood, although the enzyme concn. in blood was significantly higher than in milk serum; the similarity indicates direct transfer of enzymes from blood to milk. The *P. fluorescens* enzyme had aminopeptidase activity with high specificity for phenylalanyl derivative; this distinguished it from the milk serum enzyme, for which acetylalanyl derivative was a better substrate. [See FSTA (1976) 9 4P576 for part VII.] SKK

## 7

#### [Xanthine reduction.]

Morinaga Confection Co. Ltd.

*Japanese Examined Patent* 5 525 835 (1980) [Ja]

Xanthine derivatives in foods are decomposed by treatment with specified pseudomonas microorganisms. IFT

## 8

Effects of *Pseudomonas* development in milk stored at low temperature. (In 'Food microbiology and technology' [see FSTA (1981) 13 3B17]) [Lecture]

Bottazzi, V.; Corradini, C.; Battistotti, B. pp. 207 (1979) [En, it] [Fac. di Agraria, Univ. del S. Cuore, Piacenza, Italy]

During long storage at low temp. of raw milk on the farm, the development may occur of psychrotrophic bacteria with production of enzymes affecting milk components. In this report the effects of proteases from *Pseudomonas* are considered, according to different types of processing of milk. The influence on UHT milk gelation, curd rheology and lactic acid bacteria development in *Pseudomonas* precultured milk is discussed. Except for a few interesting perspectives related to this last case, it is generally advisable to avoid the development of psychrotrophic bacteria by storing raw milk with low bacterial count at low temp. AS

## 9

Antimicrobial effects of N $\alpha$ -palmitoyl-L-lysyl-L-lysine ethyl ester dihydrochloride and its use to extend the shelf life of creamed Cottage cheese.

Mills, C. J.; Richardson, T.; Jasensky, R. D.

*Journal of Agricultural and Food Chemistry* 28 (4) 812-817 (1980) [18 ref. En] [Dep. of Food Sci., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

The antimicrobial acyldipeptide N $\alpha$ -palmitoyl-L-lysyl-L-lysine ethyl ester dihydrochloride (R-1) was synthesized, and its activity was tested against spoilage organisms and pathogens sometimes found in dairy products. Antimicrobial activity was observed at  $< 10 \mu\text{g/ml}$  in nutrient broth. R-1 concn. of  $500 \mu\text{g/ml}$  were required to inhibit spoilage organisms added to sterile reconstituted dried skim milk. A bacteriostatic effect was observed for *Staphylococcus aureus* in vanilla pudding held at  $21^\circ\text{C}$  using R-1 at  $1500 \mu\text{g/g}$ . The shelf-life of creamed Cottage cheese stored at  $7^\circ\text{C}$  was extended 2-3-fold (to about 26 days) at an R-1 concn. of  $750 \mu\text{g/g}$ . The shelf-life of creamed Cottage cheese stored at  $7^\circ\text{C}$ , inoculated with *Pseudomonas putrefaciens* or *Achromobacter pestifer* was extended 2-3-fold over the control at an R-1 concn. of  $1500 \mu\text{g/g}$ . At concn. of  $1500 \mu\text{g/g}$  in creamed Cottage cheese, R-1 lent a bitter taste to the product. The inhibitor may have potential application as a sanitizing agent at a level of  $50 \mu\text{g/ml}$ . Almost complete hydrolysis of the compound to lysine was effected with trypsin and pancreatin. AS

## 10

Production and utilization of *Pseudomonas fluorescens* peptidases. (In 'Food process engineering 1979' [see FSTA (1981) 13 4E167]) [Lecture]

Mälkki, Y.; Mattsson, R.

Abstr. no. 4.2.12 (1979) [En] [Tech. Res. Cent. of Finland, Food Res. Lab., Espoo, Finland]

Peptidases capable of hydrolysing 60-90% of the peptide bonds of milk protein to free amino acids have been isolated from *Pseudomonas fluorescens*. These have potential applications in cheesemaking and for production of protein hydrolysates. Peptidase production was increased by mutagenic treatments e.g. UV irradiation and nitrosoguanidine. A pilot scale fermenter gave better yields than in laboratory experiments. The enzymes were isolated by centrifuging, ultrafiltration and freeze-drying without loss of activity. *Pseudomonas* peptidase shortened the ripening time of Cheddar cheese and further development for cheesemaking use is in progress. ELC

## 11

Degradation of myofibrils and formation of premeromyosin by a neutral protease produced by *Pseudomonas fragi*.

Porzio, M. A.; Pearson, A. M.

*Food Chemistry* 5 (3) 195-199 (1980) [13 ref. En] [Michigan State Univ., E. Lansing, Michigan 48824, USA]

Rabbit muscle myofibrils were treated with a neutral protease (protein:enzyme ratio 200:1) isolated from *Pseudomonas fragi* at  $0^\circ\text{C}$  in  $100 \text{ mM KCl}$ ,  $5.0 \text{ mM CaCl}_2$ ,  $0.2 \text{ mM DTT}$  (dithiothreitol) and  $20 \text{ mM Tris-HCl}$  (pH 7.5) for 0-60 min. SDS (sodium dodecylsulphate)-



polyacrylamide disc gel electrophoresis showed extensive fragmentation of the myofibrillar proteins. 3 of the major products correspond in mol. wt. to heavy meromyosin (HMM), light meromyosin (LMM) and the recently discovered premeromyosin (PMM). Results demonstrated that the neutral protease produced by *P. fragi* is capable of hydrolysing myosin and probably plays an important role in microbial breakdown of the muscle proteins during meat spoilage. AS

## 12

**[Determination of the aerobic bacterial count of vacuum-packaged beef during cold storage.]**

Kontrolle des aeroben Keimgehaltes  
vakuumverpackten Rindfleisches während der  
Kühlagerung.

Beyer, K.

*Fleischerei* 31 (9) 939-942 (1980) [De] [Inst. für Lebensmittelhygiene, Fleischhygiene & -Tech., Freie Univ. Berlin, D-1000 Berlin 33]

Studies were conducted on counts of aerobic bacteria in beef pieces vacuum-packaged in 10 kg batches and stored at 2°C for ≤5 wk. The results show bacterial counts of meat pieces from a single vacuum pack to differ by a factor of  $10^2$ - $10^3$ ; bacterial counts of subsamples from single meat pieces differed to a much smaller extent, whereas counts differed considerably between vacuum packs. Total count changed little during the first wk of storage, increased by a factor of 10-100 during the next 2 wk, then remained approx. constant. *Pseudomonadaceae* comprised a large proportion of the microflora throughout storage; counts of lactobacilli increased rapidly during storage. Yeast count increased slowly to a max. after approx. 4 wk, then declined slightly. *Micrococcus* sp. count decreased gradually during storage. Total Enterobacteriaceae count increased during the first 3 wk of storage to reach a max of approx.  $10^5$ /g, then remained approx. constant. Little qualitative change in the Enterobacteriaceae flora during storage was observed. No pathogenic Enterobacteriaceae were detected. The results are discussed in relation to the hygienic quality and shelf-life of vacuum-packaged beef. AJDW

## 13

**Continuous production of L-alanine using *Pseudomonas dacunhae* immobilized with carrageenan.**

Yamamoto, K.; Tosa, T.; Chibata, I.

*Biotechnology and Bioengineering* 22 (10) 2045-2054 (1980) [13 ref. En] [Dep. of Biochem., Res. Lab. of Applied Biochem., Tanabe Seiyaku Co. Ltd., 16-89, Kashima-3-chome, Yodogawa-ku, Osaka, Japan]

A method for continuous production of L-alanine for use as a food additive involves immobilizing *Pseudomonas dacunhae* cells with carrageenan gel on a column, and incubating the immobilized cells with ammonium L-aspartate and pyridoxal-5'-phosphate for 20 h to increase their enzyme activity. Ammonium L-aspartate is passed upwards through the column at 37°C (8 h retention time) and completely converted to L-alanine. Operational stability was increased, but enzyme activity decreased by glutaraldehyde treatments. LH

## 14

**[Effect of temperature and duration of heat treatment on *Pseudomonas aeruginosa* survival in meat broth and milk.]**

Pogorzelska, E.; Szteyn, J.; Radkowski, M.

*Zeszyty Naukowe Akademii Rolniczo Technicznej w Olsztynie, Technologia Żywności* No. 15, 159-165

(1979) [17 ref. Pl, ru, en] [Katedra Higieny Produktów Zwierzęcych, AR-T, Olsztyn, Poland]

Samples of boiled milk and of meat broth were inoculated with *P. aeruginosa* at  $2.5 \times 10^4$ - $1.0 \times 10^5$  cells/ml, and  $3.0 \times 10^4$ - $1.6 \times 10^5$  cells/ml resp. and were heated at 40, 50, 55, 60, 65, 70 or 75°C for 5, 15 or 30 min. Survival of the organism was measured by colony count on King's medium B with nitrofurantoin [see FSTA (1974) 6 12A532]. A marked lethal effect was obtained after heating at 50°C for 15 and 30 min: with milk, 89.9 and 99.8% kill resp. and with broth, 84.4 and 99.7% kill resp. Complete destruction was achieved in both media after heating at 70°C for 30 min. SKK

## 15

**Hydrolysis of edible fats caused by lipase from *Pseudomonas fluorescens*.**

Andersson, R.

*SIK Rapport* No. 465, 15pp. (1980) [50 ref. En] [Swedish Food Inst., Box 27 022, S-400 23 Göteborg, Sweden]

Studies on the characteristics and activity of a lipase from *Pseudomonas fluorescens* are summarized. Aspects considered include: heat stability; resistance to chemical denaturation; concentration and partial purification of *Ps. fluorescens* lipase; lipase production and lipase activity at low temp. and low  $a_w$ ; lipolysis in fat-containing media; effects of preservatives on growth and lipase production by *Ps. fluorescens*; hydrolysis of food lipids; and formation of volatiles during hydrolysis of fats. AJDW

## 16

**Influence of certain processing steps on attachment of microorganisms to pork skin.**

Butler, J. L.; Vanderzant, C.; Carpenter, Z. L.

Smith, G. C.; Lewis, R. E.; Dutson, T. R.

*Journal of Food Protection* 43 (9) 699-705 (1980)

[13 ref. En] [Dep. of Anim. Sci., Texas Agric. Exp. Sta., Texas A&M Univ., College Station, Texas 77843, USA]

*Pseudomonas putrefaciens* and lactobacillus counts of inoculated pork skin obtained with the maceration method were usually higher than were those obtained with the rinse method. Scalding and dehairing and shaving caused extensive destruction of the test organisms when placed on the skin before these slaughter-dressing steps. Smaller decreases in count occurred during singeing and washing and during evisceration and washing. Increases in S value (log count by maceration method minus log count by rinse method) for *P. putrefaciens* and a *Lactobacillus* sp. after freezing-thawing of inoculated pork skin may be related to a higher death rate of bacteria in the water film than for those entrapped in skin crevices. *P. putrefaciens* and the *Lactobacillus* sp. that were attached to pork skin



exhibited greater heat resistance than did those bacteria which were not attached to skin. During storage of inoculated pork skin, S values of *P. putrefaciens* and the *Lactobacillus* sp. increased; this increase probably reflects increased strength of attachment of bacteria to the skin. Scanning electron microscopy of inoculated pork skin showed the formation of extracellular structures which may play a role in attachment of bacteria to skin or meat surfaces. AS

## 17

### Microbiological decaffeination of aqueous liquids.

Haas, G. J.; Stieglitz, B. (General Foods Corp.)

*United States Patent* 4 228 191 (1980) [En]

Aqueous caffeine-containing liquids e.g. coffee extracts, are decaffeinated by either fermenting the liquid with the pseudomonad microorganisms *Pseudomonas putida* NRRL B-8051, *P. fluorescens* NRRL B-8052 and *P. fluorescens* NRRL B-8053 or by contacting the liquid with a caffeine metabolizing enzyme preparation isolated from the above pseudomonad organisms. RAW

## 18

### Proteolysis and curd yield related to inhibition of *Pseudomonas fluorescens* by lactic starter culture in skim milk.

Mohammed, F. O.; Bassette, R.

*Mesopotamia Journal of Agriculture* 14 (1) 125-129 (1979) [8 ref. En, ar] [Dep. of Food Tech., Coll. of Agric. & Forestry, Mosul Univ., Hammam Al-Alil, Mosul, Iraq]

Grade A skim milk was pasteurized at 72°C for 15 s and divided into 3 portions: (i) was inoculated with *Pseudomonas fluorescens*, (ii) with *Ps. fluorescens* + 0.1% Hansen's lactic culture No. 44, and (iii) served as an uninoculated control. Cottage cheeses were made from the 3 skim milks stored at 4°C for 24, 48 or 96 h. Counts of *Ps. fluorescens* increased and Hull values decreased in skim milk (i) during 96 h storage at 4°C. Similar but less pronounced trends were found with skim milk (ii) and there was also a slight increase in psychrotrophic counts in the control skim milk (iii) during storage. Yields of Cottage cheese decreased with increasing psychrotroph counts in milk (from 14.94% with milk (iii) stored for 24 h to 13.65% with milk (i) stored for 96 h). Addition of lactic starter reduced this effect of psychrotrophs, but did not eliminate it [see also FSTA (1979) 11 9P1516]. MEG

## 19

### The effect of some preservatives on growth, lipase production and lipase activity of *Pseudomonas fluorescens*.

Andersson, R. E.; Bodin, H. G.; Snygg, B. G.

*Chemie Mikrobiologie Technologie der Lebensmittel* 6 (6) 161-164 (1980) [12 ref. En, de] [SIK Swedish Food Inst., Box 27022, S-400 23 Göteborg, Sweden]

Effect of the food preservatives (i) sodium benzoate, (ii) potassium sorbate, (iii) acetic acid, (iv) dehydroacetic acid, (v) methylparaben, (vi) propylparaben and (vii) terramycin, on growth, lipase production and lipase activity of *Pseudomonas fluorescens* was investigated;

the organism was cultivated in nutrient agar at 20°C, and olive oil was used as a substrate. Organism growth was inhibited by all preservatives, excluding (vi): min. inhibitory concn. (MIC) for pH 5.0-8.0 ranged (% w/v) (i) 0.030-1.10, (ii) 0.030-1.60, (iii) 0.010-2.60, (v) 0.030-0.055 and (vii) 4-70 p.p.m.; (vi) did not reach MIC at any pH value (> 0.025); and (iv) had MIC 0.035% at pH 5.0 but did not inhibit growth at pH 6.0-8.0 (> 0.17). When used in concn. equal to 50% of MIC, (ii) and (iii) did not affect lag phase; (i), (iv), (v) and (vi) increased lag phase by  $\geq 10$  h without significantly altering culture growth rate; and (vii) delayed growth onset. Lipase production was almost completely inhibited by (i), (iii) and (iv), was not markedly reduced by (ii), (v) and (vii), and was only partially reduced by (vi). Concn. for inhibiting lipase activity by 10% at pH 8.0 and 34°C were (%) (i) > 1.0, (ii) 1.0, (iii) 1.2, (iv) 0.05, (v) 0.05 and (vii) 85 p.p.m. RAW

## 20

### Production of a milk coagulating enzyme by *Pseudomonas maltophilia*.

Kobayashi, H.; Ishidori, T.; Kusakabe, I.; Murakami, K.; Nakamura, I.

*Journal of Fermentation Technology Osaka [Hakko Kagaku Zasshi]* 57 (4) 375-378 (1979) [6 ref. En] [Inst. Applied Biochem., Univ. of Tsukuba, Ibaraki 300-31, Japan]

## 21

### [Changes in bacterial flora of marine fish during storage by partial freezing.]

Okuzumi, M.; Shimizu, M.; Matsumoto, A.

*Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi]* 46 (4) 451-454 (1980) [17 ref. Ja, en] [Tokyo Univ. of Fisheries, Konan 4 Minato-ku, Tokyo 108, Japan]

Changes in the bacterial counts and flora of horse mackerels, *Trachurus japonicus*, during storage under partial freezing ( $-4^{\circ}\text{C}$ ) were investigated. Samples stored at  $-4^{\circ}\text{C}$  were removed periodically for organoleptic, chemical and bacteriological examination. Enumeration and isolation of bacteria was by a smear plate method using 50% seawater agar medium. Identification was mainly based on the schemes of Shewan et al. and Okuzumi et al. Bacterial count of the sample examined immediately before storage was  $1.8 \times 10^5/\text{cm}^2$  skin, and the majority of skin isolates consisted of *Pseudomonas* III/IV-NH, III/IV-H and *Vibrio*. After 12 days storage the bacterial count decreased to  $6.7 \times 10^4/\text{cm}^2$ , the combined % of the above 3 groups decreased strikingly, while those of *Moraxella*, *Acinetobacter* and *Flavobacterium-Cytophaga* groups increased. After 40 days the bacterial population was  $10^5/\text{cm}^2$ , members of *Pseudomonas* I/II and an undetermined group appeared, while the 3 dominant groups (*Moraxella* etc.) decreased markedly. After 3-4 months, bacterial numbers reached max. values of  $10^8/\text{cm}^2$  and samples gave out a typical offensive spoilage odour, and towards the end of the experiment the bacterial population consisted almost entirely of *Pseudomonas* I/II. [From En summ.] AL



## 22

**A numerical taxonomic study of *Pseudomonas*-like bacteria isolated from fish in southeastern Queensland and their association with spoilage.**  
Gillespie, N. C.

*Journal of Applied Bacteriology* 50 (1) 29-44 (1981) [48 ref. En] [Otto Madsen Res. Lab., Hamilton, Queensland 4007, Australia]

*Pseudomonas*-like bacteria isolated from fresh and spoiling fish in southeastern Queensland were subjected to a wide range of physiological and nutritional tests. The results of these tests, together with those of 20 named strains, were analysed numerically, resulting in the formation of 11 groups. Most of the isolates clustered into group 1 and group 2 which also contained the bulk of the strains able to produce spoilage odours when grown in a tryptic digest of fish muscle at 2°C. Almost all of the group 1 organisms produced sulphhydryl type odours, had only 50 mol % G + C (guanine + cytosine) and were identified as strains of *Alteromonas putrefaciens* which were deficient in the ability to produce H<sub>2</sub>S detectable in Peptone Iron Agar. Certain of the group 2 strains produced fruity and sulphhydryl type odours, but these organisms were not distinguishable from other strains in this group not producing odours. Group 2 strains were highly related to *Pseudomonas fragi* and were intermediate in properties between *Ps. fluorescens* and *Ps. putida*. The remaining 9 minor groups contained few organisms able to produce spoilage odours. AS

## 23

**Lipase production, lipolysis, and formation of volatile compounds by *Pseudomonas fluorescens* in fat containing media.**

Andersson, R. E.

*Journal of Food Science* 45 (6) 1694-1701 (1980) [36 ref. En] [SIK - Swedish Food Inst., Box 27022, S-400 23 Göteborg, Sweden]

The lipolytic bacterium *P. fluorescens* was cultivated in nutrient broth supplemented either with olive, sunflower or soy oil. Presence of oil delayed bacterial growth and lipase production, but the finally obtained cell density and amount of lipase was approx. the same as in unsupplemented nutrient broth. The lipase hydrolysed soy oil to a greater extent than olive and sunflower oils. Fatty acids were broken down into volatile compounds which were detected in the headspace gas over the fat-containing media. The volatile fraction was found to contain alcohols, aldehydes, ketones, esters, furans, S compounds and hydrocarbons. IFT

## 24

**[Criteria of bacteriological quality for payment for refrigerated milk.]**

François, A.

*Technique Laitiere* No. 950, 17-19 (1981) [Fr]

A working group of CNERNA was set up to study the bacteriological quality of milk and assess the validity of the total colony count at 30°C as the criterion for milk payment to the producer. It was found that, at the time of collection from the farm tank, generally 48 h after the 1st milking into the tank, *Pseudomonas* spp. accounted for most or all of the microbial flora of the

milk. Thus at the time of testing milk for payment, the psychrotrophic count was not substantially different from the total count at 30°C. It is concluded that replacing total count (3 days at 30°C) with psychrotrophic count (10 days at 7°C) would not be justified for milk payment to the producer. CDP

## 25

**Inhibition of two psychrotrophic *Pseudomonas* species by butylated hydroxyanisole.**

Davidson, P. M.; Branen, A. L.

*Journal of Food Science* 45 (6) 1603-1606 (1980) [18 ref. En] [Dep. of Food Sci. & Tech., Washington State Univ., Pullman, Washington 99164, USA]

Antimicrobial activity of the phenolic antioxidant, butylated hydroxyanisole (BHA), was evaluated against *Pseudomonas fluorescens* and *P. fragi*; *P. fluorescens* ATCC 15456 was extremely susceptible to the antimicrobial effects of BHA. In Trypticase Soy Broth (TSB), 100 p.p.m. BHA delayed growth of *P. fluorescens* at 22°C and totally inhibited growth at 7°C. In phosphate-peptone buffer, 100 or 200 p.p.m. BHA was lethal to *P. fluorescens*. Extent of lethality was dependent on BHA concn., temp. and prior exposure to sub-inhibitory levels of BHA. In contrast to *P. fluorescens*, growth occurred with *P. fragi* ATCC 4973 in TSB even at 400 p.p.m. BHA at 7°C and 22°C. *Pseudomonas fragi* was also more resistant to the lethal effects of BHA in phosphate-peptone buffer. IFT

## 26

**Antimicrobial mechanisms of butylated hydroxyanisole against two *Pseudomonas* species.**

Davidson, P. M.; Branen, A. L.

*Journal of Food Science* 45 (6) 1607-1613 (1980) [27 ref. En] [Dep. of Food Sci. & Tech., Washington State Univ., Pullman, Washington 99164, USA]

Exposure of *Pseudomonas fluorescens* and *P. fragi* cells to butylated hydroxyanisole (BHA) resulted in a rapid loss of UV absorbing material and previously incorporated <sup>14</sup>C-labelled compounds from the cells. *Pseudomonas fluorescens* lost a max. of 15.3% of the incorporated <sup>14</sup>C-label when incubated with 200 p.p.m. BHA and 8.0% when incubated with 100 p.p.m. BHA. *Pseudomonas fragi* was more resistant to BHA, losing only 6.4% of the label at 200 p.p.m. and 2.1% at 100 p.p.m. It was determined that lethality was at least partially due to leakage. The relative % of phospholipids in *P. fragi* and major fatty acids in both *P. fragi* and *P. fluorescens* were altered by growth in the presence of various concn. of BHA. IFT

## 27

**Isolation and identification of acetic acid bacteria for submerged acetic acid fermentation at high temperature.**

Ohmori, S.; Masai, H.; Arima, K.; Beppu, T.

*Agricultural and Biological Chemistry* 44 (12) 2901-2906 (1980) [9 ref. En] [Dep. of Agric. Chem., Fac. of Agric., Univ. of Tokyo, Tokyo 113, Japan]

To obtain strains suited to high temp. fermentation, approx. 1100 acetic acid bacteria strains were isolated from various samples of vinegar factory soils, vinegar mash and spoiled fruit (apples, peaches etc.). Isolates were grown for 2-5 days on 3 acidified media at 30°, 37°



and 40°C, i.e. yeast/glucose (YG), yeast/glucose/mannitol (YGM) and Koji extract (K) after enrichment in the same media at 30°, 37° or 40°C. Pure cultures thus obtained were grown on agar slants for 2 days at 30°C and stocked at 4°C, with transfer to fresh slants bimonthly. Of the strains examined, No. 1023 (*Acetobacter aceti*) retained full ethanol oxidation activity in continuous submerged culture at 35°C, and 45% of this activity at 38°C. This strain may therefore be used to reduce cooling costs in industrial vinegar production. LH

## 28

### Production of single-cell protein from methanol by a bacterium.

Miura, Y.; Okazaki, M.; Komemushi, S.; Sakata, T.; Shiroza, S.; Obana, S.

*Journal of Fermentation Technology [Hakko Kogaku Zasshi]* 57 (2) 124–129 (1979) [17 ref. En] [Dep. of Biochem. Eng., Fac. of Pharmaceutical Sci., Osaka Univ., Suita, Osaka 565, Japan]

By screening  $C_1$ -assimilating microorganisms, several species of methanol-assimilating bacteria with excellent characteristics have been isolated from soils. One of them belongs to the genus *Pseudomonas*. This bacterium showed a high productivity of 6.2 g-cells/l  $\times$  h, a cell concn. of 32.5 g-cells/l and a high cell yield of 0.448 g-cells/g-methanol in continuous culture in medium containing 72.6 g-methanol/l with a dilution rate of 0.19 h<sup>-1</sup>. The contents of true cellular protein were 68%. This bacterium showed a low maintenance constant of 0.02 g-methanol/g-cell  $\times$  h. AS

## 29

### Properties of pseudomonads causing spoilage of vegetables stored at low temperature.

Brocklehurst, T. F.; Lund, B. M.

*Journal of Applied Bacteriology* 50 (2) 259–266 (1981) [39 ref. En] [Agric. Res. Council, Food Res. Inst., Colney Lane, Norwich NR47UA, UK]

24 strains of pectolytic, fluorescent pseudomonads were isolated from soft rots of celery stored at 0.4–1°C and 5 strains were isolated from soft rots in cabbage stored at 1°C. When inoculated into the vegetable from which they were isolated these bacteria caused soft rot of wounded, but not of unwounded tissue. According to their biochemical reactions, the organisms were divided into 3 groups; Group 1 (15 strains) were identified with *Pseudomonas fluorescens* Biotype II (Doudoroff & Palleroni 1974 [in *Bergey's manual of determinative bacteriology*, 8th ed., Williams & Wilkins Co., pp. 217–243]) (*Ps. marginalis*); Group 2 (12 strains) and Group 3 (2 strains) would be included in the 'Miscellaneous strains' of *Ps. fluorescens* described by the above authors. One strain biochemically representative of Group 1 showed a max. growth rate at 27°C (doubling time, 0.88 h) and a doubling time at 0.2°C of 14.9 h. A strain representative of Group 2 showed a max. growth rate at 29°C (doubling time 0.96 h) and a doubling time at 0.2°C of 16.6 h. Neither strain grew at 36°C. The temp. characteristics (calculated for the range 0.2–20.8°C) were 83 011 and 79 534 J/mol, resp. The mean doubling time for the remaining Group 1 strains at 0.2°C was 17.6 h and for remaining Group 2 strains was 17.1 h. AS

## 30

### Effect of proteolytic bacteria in the natural fermentation of corn to increase its nutritive value.

Tongnual, P.; Nanson, N. J.; Fields, M. L.

*Journal of Food Science* 46 (1) 100–104, 109 (1981) [15 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Missouri, Columbia, Missouri 65211, USA]

There was no significant difference in % relative nutritive value, lysine or tryptophan levels between natural lactic fermentations of Costa Rican corn meal fermented with tap water of pH 7.2 and 5.3. However, the fermented values were all significantly ( $P < 0.05$ ) higher than nonfermented values. Most of the increase in % relative nutritive value occurred in the first 48 h. Free essential amino acids increased and the amino acid balance changed during typical fermentations. Proteolytic bacteria [*Pseudomonadaceae*] decreased after 3 days fermentation and declined to a few cells/ml by the 4th day. Proteolysis decreased by the 2nd day of natural lactic fermentation. IFT

## 31

### [Hydrogen sulphide concentration in egg products.]

Cantoni, C.; Radaelli, A.; Cattaneo, P.

*Industria Alimentari* 19 (10) 749–752 (1980) [11 ref. It, en] [Istituto di Ispezione degli Alimenti di Origine Anim., Univ. degli Studi, Milan, Italy]

As  $H_2S$  is produced when white and/or yolk of egg is heated above pasteurization temp. (73–74°C) or contaminated by pseudomonads, research was carried out into ways of assessing the freshness of raw materials used for manufactured egg products. Egg samples ((i) 13 of dried white, (ii) 12 of dried yolk, (iii) 5 of dried whole egg, and (iv) 5 of frozen mixed whole egg, of good microbiological quality, and (v) 5 as (iv) but contaminated by pseudomonads) were analysed for  $H_2S$  concn. by colorimetry using dimethyl-*p*-phenylene diamine reagent and protein and moisture contents [Pearson, H. (1976) *The chemical analysis of foods*; Butterworths]. Results (tabulated) showed considerable variation in  $H_2S$  concn.: (i) 14.62–139.74, (ii) 42.16–102.34, (iii) 9.86–169.32, (iv) 72.76–199.58, (v) 214.54–503.20 mg/g protein), evidencing a lack of consistent quality. All the samples affected by *Pseudomonas* sp. had extremely high  $H_2S$  concn. It is claimed that such detn. affords an excellent check on the freshness and microbiological quality of egg product ingredients. KME

## 32

### Acetic acid production by immobilized *Acetobacter* cells.

Ghommdh, C.; Navarro, J. M.; Durand, G.

*Biotechnology Letters* 3 (2) 93–98 (1981) [9 ref. En] [INSA, Avenue de Rangueil, 31077 Toulouse Cedex, France]

Using a pulsed gas and liquid flow and with cells directly adsorbed onto a suitably formed support, aerobic transformations can be carried out in a fixed-cell reactor with significant gain in efficiency. Immobilized cells of *Acetobacter* on cordierite can produce acetic acid at a high rate which, at different dilution rates, may be limited either by product inhibition or by oxygen transfer requirements. AS



## 33

**Effect of a heat-resistant microbial lipase on flavor of ultra-high-temperature sterilized milk.**

Andersson, R. E.; Danielsson, G.; Hedlund, C. B.; Svensson, S. G.

*Journal of Dairy Science* 64 (3) 375-379 (1981) [15 ref. En] [SIK - Swedish Food Inst., Box 27022, S-400 23 Gothenburg, Sweden]

A heat-resistant microbial lipase from *Pseudomonas fluorescens* was added to cows' milk at 118 and 564 units/l. After sterilization in a Vacu-Therm Instant Sterilizer at 138°C for 2 s the milk was cold-stored at 8°C for 22 days. The acid degree value and flavour changes were followed during storage. The samples containing lipase showed a rapid increase in acid degree value compared with a control containing inactivated enzyme. The lipase also had a pronounced effect on formation of rancid flavour. The sample with the highest enzyme activity, about 0.3 units/ml, was perceived as 'rancid' after 5-8 days. Significant flavour changes appeared in all samples when the acid degree value exceeded 20. AS

## 34

**Influence of oxygen transfer rate on vinegar production by *Acetobacter aceti* in submerged fermentation.**

Levonen-Munoz, E.; Cabezudo, M. D.

*Biotechnology Letters* 3 (1) 27-32 (1981) [12 ref. En] [Ass. do Investigacion de la Ind. Vinagrera, Madrid, Spain]

The influence of  $O_2$  transfer rate on bacterial growth and acid production was studied in submerged vinegar fermentation by an industrial culture of *Acetobacter aceti*. The rate of vinegar production and growth rate increased with rising  $O_2$  transfer rate, even if no increase in cell mass was observed (i.e. increase in  $O_2$  transfer rate increased production rate independently of bacterial growth, probably by stimulating enzyme activity). The relation between growth and production followed a mixed growth associated model. RM

## 35

**[Studies on the effects of psychrotrophic bacteria on milk quality. V. Relationship between quality tests and flavour deterioration of market milk, laboratory pasteurized milk and *Pseudomonas fluorescens* inoculated milk.]**

Mikawa, K.; Arima, S.

*Memoirs of the Faculty of Agriculture, Hokkaido University* 11 (4) 360-371 (1979) [49 ref. Ja, en] [Dep. of Anim. Sci., Hokkaido Univ., Hokkaido, Sapporo, 060 Japan]

Samples of commercially pasteurized milk (market milk), laboratory pasteurized milk (75°C for 15 min) and market milk inoculated with *Pseudomonas fluorescens* were stored at 6°C for up to 29 days. Before and during storage samples were tested for psychrotrophic count (PTC), titratable acidity, proteolysis (absorbance of trichloroacetic acid soluble N at 660 nm, A660), volatile basic N (VBN), fat acidity, heat coagulation without and with  $KH_2PO_4$ , and alcohol precipitation. In 9 samples of

market milk an off-flavour was detected after 8-17 days of storage and this was associated with significant increases in PTC ( $P < 0.001$ ) and VBN ( $P < 0.05$ ). In 6 samples of laboratory pasteurized milk, an off-flavour was detected after 11-17 days; only the rise in PTC was significant. In 6 samples of milk inoculated with the pseudomonad, off-flavour was detected after 5-14 days, and changes in PTC ( $P < 0.001$ ) and titratable acidity ( $P < 0.05$ ) were significant. Estimated significant critical values were as follows: PTC in market milk  $2 \times 10^7$ /ml, in laboratory pasteurized milk  $1 \times 10^6$ /ml and in milk with the pseudomonad;  $6 \times 10^7$  (>90% coincidence with flavour test); titratable acidity, 0.140% lactic acid equivalent (79-85% coincidence); A660, 0.140 in market milk and 0.150 in milk with the pseudomonad; VBN, 0.75 mg% in market milk and 0.70-0.80 mg% in milk with the pseudomonad; fat acidity, 2.5-3.0 mmol KOH/100 g in market milk and 2.4-2.8 mmol KOH/100 g in milk with the pseudomonad. The heat coagulation test with  $KH_2PO_4$  was significant only for milk with the pseudomonad (93% coincidence); the conventional heat coagulation and alcohol tests were not significant. The critical values for commercially pasteurized milk and milk with the pseudomonad were similar to or lower than those estimated for raw milk [see part IV preceding abstr.]. Except for PTC and titratable acidity, significant critical values were not found for quality parameters in laboratory pasteurized milk. Titratable acidity was significantly correlated with PTC and fat acidity in market milk and milk with the pseudomonad. BWH

## 36

**Hydrolysis of milk proteins by microbial enzymes.**

Gebre-Egziabher, A.; Humbert, E. S.; Blankenagel, G.

*Journal of Food Protection* 43 (9) 709-712 (1980) [21 ref. En] [Dep. of Dairy & Food Sci., Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W0]

Raw skim milk was incubated at 7°C for 15 days after inoculation with 6 strains of *Pseudomonas* spp., previously isolated from raw milk. Polyacrylamide gel electrophoresis showed that all 6 strains hydrolysed milk proteins. After 9 days storage at 7°C, losses of  $\kappa$ -,  $\beta$ - and  $\alpha$ -casein were 61-91, 62-89 and 19-76%, resp., and after 15 days there were no traces of  $\kappa$ - or  $\beta$ -casein and a considerable loss of  $\alpha$ -casein. Most of the isolated psychrotrophs required extended incubation periods for hydrolysis of the whey proteins. When 1 strain (isolate 22) was inoculated into commercially processed UHT milk, cell counts increased from 1300 to 27 000/ml within 2 days at 7°C. At this time, 26 proteinase units were present (1 proteinase unit being defined as the amount of enzyme producing 1  $\mu$ g acid-soluble tyrosine/ml enzyme solution/24 h at 40°C). A bitter flavour appeared after 4 days storage, when the cell count reached 2.5 million/ml and the enzyme level was 64 units. Addition of 9.8 enzyme units to UHT milk caused a bitter flavour within 28 days at 7°C and in <3 days at room temp. (21°C); 2 units produced bitterness in 7 days at room temp. DMK

## 37

[Survival of *Pseudomonas aeruginosa* in frozen beef.]

Pogorzelska, E.

*Medycyna Weterynaryjna* 35 (5) 273-275 (1979)

[32 ref. Pl, ru, en] [Katedra Higieny Produktów Zwierzecznych, Wydział Weterynaryjny, AR-T, Olsztyn, Poland]

Raw beef was ground 3 × in a sterilized mincer and contaminated with a freshly prepared suspension of a 24-h culture of a strain of *P. aeruginosa* from the collection of the State Institute of Hygiene in Warsaw, Poland, 50 ml suspension being mixed with 1 kg ground meat. The contaminated meat was divided into 25 portions of about 40 g each, which were frozen at -23°C and stored at this temp. for ≤ 183 days. Samples were examined at intervals for survival of *P. aeruginosa*, using a nitrofurantoin medium [see Thom et al., *Journal of Applied Bacteriology* (1971) 34 (3) 611]. Mean values with s.d. for 3 series of 21 examinations are tabulated. The initial colony count of  $(6.61 \pm 1.13) \times 10^7/\text{g}$  was reduced to  $(4.64 \pm 0.84) \times 10^7/\text{g}$  (70%) after 4 days, to  $(3.97 \pm 0.94) \times 10^7/\text{g}$  (60%) after 29 days, to  $(3.31 \pm 0.68) \times 10^7/\text{g}$  (50%) after 58 days, and was  $(2.73 \pm 0.45) \times 10^7/\text{g}$  (41%) at the end of the experiment. SKK

## 38

The influence of temperature on the growth inhibitory effect of carbon dioxide on *Pseudomonas fragi* and *Bacillus cereus*.

Enfors, S.-O.; Molin, G.

*Canadian Journal of Microbiology* 27 (1) 15-19 (1981)

[14 ref. En, fr] [Tech. Microbiol., Chem. Cent., S-220 07 Lund, Sweden]

The growth inhibitory effect of 50 kPa (0.5 atm) CO<sub>2</sub> was tested for *P. fragi* in the temp. range 5-35°C and of 101 kPa (1 atm) CO<sub>2</sub> on *B. cereus* in the range 18-46°C. The max. specific growth rate ( $\mu_{\text{max}}$ ) of *P. fragi* in air (pH 6.7) was 0.44 h<sup>-1</sup> at 35°C, 0.65 h<sup>-1</sup> at 30°C, and 0.078 h<sup>-1</sup> at 5°C. In 50 kPa of CO<sub>2</sub> in air the relative inhibition of the growth rate was about 30% at 35°C, 50% at 30°C, and 90% at 5°C. Thus, the inhibitory effect of CO<sub>2</sub> successively increased with decreasing temp. an effect which was explained by the increasing solubility of CO<sub>2</sub> with decreasing temp. The anaerobic growth of *B. cereus* (101 kPa N<sub>2</sub>) was optimal at 40°C and stopped at temp. below 18°C and above 46°C. The relative inhibitory effect of 101 kPa CO<sub>2</sub> at the optimum growth temp. was about 40%; this increased to 100% near the max. and min. growth temp. The growth inhibitory effect of reduced temp. (below optimum) and CO<sub>2</sub> on *B. cereus* was larger than that expected from the increased solubility of CO<sub>2</sub> at lower temp. AS

## 39

[Acetic bacteria of grapes, musts and wines; their presence during storage in barrels.]

Ribereau-Gayon, P.; Lafon-Lafourcade, S.; Dulbecco, M.; Joyeux, A.

*Semana Vitivinicola* 36 (1806) 1035 (1981) [Es]

The presence of acetic acid bacteria on grapes and during wine making and storage was investigated. High counts were observed on healthy white (10<sup>4</sup> cells/ml) and red grapes (10/ml), increasing by 10-100 fold in

rotten grapes (where counts may be as high as, or higher than, those of yeasts). At the start of fermentation counts of 10<sup>4</sup>-10<sup>5</sup>/ml are observed in white musts, 10<sup>3</sup>/ml in red must, falling to 10<sup>2</sup>/ml, mainly due to reduction in *Gluconobacter* while *Acetobacter* sp. predominates. At decanting of red wine, counts increase and *Gluconobacter* reappears for about 3 wk. After 3 wk, 77% of the acetic acid bacteria consists of *Acetobacter aceti*. Selective microbial counts during 1 yr of storage in barrels frequently showed acetic bacteria to be present, while no lactic acid bacteria or yeasts were observed. They were mainly found at the bottom of the barrels, but survived even in the presence of 30 mg free SO<sub>2</sub>/l and 80 mg combined SO<sub>2</sub>/l, under anaerobic conditions. They can explain the slow rise in volatile acidity during storage of high pH wines, completely free of yeasts or lactic acid bacteria. RM



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FAB 43

PSEUDOMONADACEAE AND FOOD PROCESSING

SELECTED FROM VOLUME 11

FOOD SCIENCE AND TECHNOLOGY ABSTRACTS.

under the direction of

Commonwealth Agricultural Bureaux, Farnham Royal, Bucks; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublikaties en Landbouwdocumentatie (Pudoc), Wageningen.





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Some of the larger FABs have been divided into sections to facilitate use. FAB 47 also has a subject and author index provided.

Copies of all original articles referred to in the abstracts may be bought ( or occasionally borrowed) from the International Food Information Service. A form for ordering these is provided at the end of this FAB.

Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES

EDITOR



## 1

**Characteristics of tyrosine phenol-lyase from *Aeromonas phenologenes* ATCC 29063.**

Carman, G. M.; Levin, R. E.

*Journal of Food Biochemistry* 1 (3) 285-299 (1977, publ. 1978) [14 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Massachusetts, Amherst, Massachusetts 01003, USA]

Tyrosine phenol-lyase catalyses the conversion of L-tyrosine to phenol, pyruvate, and  $\text{NH}_3$ . The activation energy for the reaction was calculated to be 13 000 cal/mol. The heavy metal  $\text{Cu}^{2+}$  was found to result in a mixed type of inhibition ( $K_i$  0.20mM). Addition of mercaptoethanol was found to reverse the inhibition by  $\text{Cu}^{2+}$ . Competitive inhibition was found with amino acids L-alanine ( $K_i$  18mM) and L-phenylalanine ( $K_i$  4.4mM). Phenol, an end product of the tyrosine phenol-lyase reaction, was also found to inhibit enzyme activity ( $K_i$  50mM). Tyrosine phenol-lyase catalysed the formation of pyruvate from L-tyrosine methyl ester, S-methyl-L-cysteine, and L-serine but at rates lower than with L-tyrosine.  $K_m$  values for L-tyrosine methyl ester, S-methyl-L-cysteine, and L-serine were found to be 0.37mM, 0.40mM, and 1.2mM, resp. The reverse reaction by which L-tyrosine is produced from phenol, pyruvate, and  $\text{NH}_3$  was demonstrated. The pH optimum for the reverse reaction was found to be 9.0 and the  $K_m$  for phenol 5.0mM. AS

## 2

**Use of naturally occurring antimicrobials to preserve non-fermented refrigerated foods.**

Go, H. C.

*Dissertation Abstracts International*, B 38 (6) 2602-2603: Order No. 77-25769, 117pp. (1977) [En] [N. Dakota State Univ., Fargo, N. Dakota 58102, USA]

Antimicrobial substances produced by *Streptococcus diacetylactis* DRC-1 and *Leuconostoc citrovorum* 3036 were investigated. Lactic or acetic acids accounted for most of the inhibitory activity found in the L. citrovorum culture liquor; 20-30 % of the antimicrobial activity from S. diacetylactis culture liquor was due to ninhydrin-positive substances. 2 % lyophilized cell-free culture liquor from S. diacetylactis inhibited growth of *Pseudomonas fluorescens* and of a Gram-negative species in skim-milk stored at 7° C for 2-3 wk, but did not prevent proteolysis. Growth of the Gram-negative species in a beef homogenate and growth of Gram-negative psychrotrophs in a fish homogenate were also inhibited and proteolysis was prevented. Addition of 0.1-0.8 % of a proteolytic enzyme inhibitor from potatoes did not inhibit growth of P. fluorescens in skim-milk or of the Gram-negative species in beef homogenate, but proteolysis was prevented. MEG

## 3

**Requirements of high concentrations of organic substances by bacteria isolated from 'kusaya' brine.**

Fujii, T.

*Bulletin of the Japanese Society of Scientific Fisheries [Nihon Suisan Gakkai-shi]* 43 (5) 609 (1977) [1 ref. En] [Tokai Regional Fisheries Res. Lab., Chuo-ku, Tokyo, Japan]

2 bacterial strains, a *Corynebacterium* sp. and a *Pseudomonas* sp., isolated from kusaya brine required

25 and 5 g/l. peptone, in addition to 5 g/l. extract bonito, in order to grow during 7 days incubation. The concn. of organic substances supporting half-maximal growth rates were approx. 23, 55 and 5 g/l. for the *Pseudomonas* sp., the *Corynebacterium* sp. and a *Vibrio-Aeromonas* strain used as a control, resp. JRR

## 4

**Effect of endocellular enzymes from *Pseudomonas fragi* on the color of beef and aqueous beef extract.**

Bala, K.; Marshall, R. T.; Stringer, W. C.; Naumann, H. D.

*Journal of Food Science* 43 (3) 684-688 (1978) [20 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Missouri, Columbia, Missouri 65201, USA]

*Pseudomonas* discoloration of beef was investigated with the use of an endocellular enzyme preparation from P. fragi (ATCC 4973). The preparation contained glucose oxidase and catalase, but not cytochrome oxidase. Sterile beef samples were dipped for 5 min in the sterile enzyme solution (10 mg lyophilized enzyme/ml) and stored in Petri dishes at 4° C for 0-48 h or at 21° C for 0-12 h. Sterile aqueous beef extract samples received 1 mg/ml lyophilized enzyme preparation and were stored at 4° C for 0-24 h or at 21° C for 0-6 h. Colour measurements (Hunter L, a and b values), and % myoglobin (Mb), oxymyoglobin ( $\text{O}_2\text{Mb}$ ) and metmyoglobin (MMb) are tabulated for each treatment. Thiobarbituric acid values and pH were measured, and sodium dodecyl sulphate polyacrylamide gel analysis was performed, for all samples. Analyses of variance and correlation coeff. between parameters measured in beef and beef extract samples are tabulated. Enzyme-treated samples had lower redness values ( $P < 0.05$ ), more discoloration ( $P < 0.05$ ) and lower %  $\text{O}_2\text{Mb}$  ( $P < 0.05$ ) than control samples. There were significant ( $P < 0.05$ ) positive correlations between 'a' (redness) values and %  $\text{O}_2\text{Mb}$ . Falls in  $\text{O}_2\text{Mb}$  concn. correlated with increases in MMb concn. No lipid oxidation, protein degradation, or microbial growth was detected in any sample. It is concluded that glucose oxidase in the P. fragi preparation consumes  $\text{O}_2$ , thereby causing oxidation of  $\text{O}_2\text{Mb}$  to MMb. DIH

## 5

**[The bacteriology of mineral waters: effect of PVC on the growth of *Pseudomonas aeruginosa* and *Pseudomonas fluorescens*.]**

Masson, A.; Michel, R.

*Industries Alimentaires et Agricoles* 95 (5) 503-507 (1978) [3 ref. Fr, de, en]

The effect of PVC on the growth of Ps. aeruginosa and Ps. fluorescens was investigated. In 2 in vitro experiments, the growth of Ps. aeruginosa was accelerated 25x, and that of Ps. fluorescens 44x, in the presence of powdered PVC. Both organisms grew strongly during 1 month in either glass or plastics bottles at room temp. (20° C). While Ps. fluorescens generally grew faster than Ps. aeruginosa, the latter grew faster in plastics than in glass. The differences may be attributed to the appearance of mutants. RM



## 6

The biosynthesis of cellulose by *Acetobacter aceti*, a producer of fermentation food. [Lecture]  
Yamanaka, S.; Takinami, K.; Osumi, M.

*International Congress of Food Science & Technology - Abstracts* p.269 (1978) [En] [Cent. Res. Lab. of Ajinomoto Co. Inc., Kawasaki, Japan]

*A. aceti* produces extracellular cellulose microfibrils which enmesh the bacterial cells to yield a cellulosic product (nata) which is eaten in the Philippines. An attempt was made to establish the optimum cultural conditions for *A. aceti* and to study the morphological aspects of biosynthesis of the cellulosic polysaccharide. Polysaccharide production was greatest in a liquid medium containing 10% sucrose, 0.5%  $(\text{NH}_4)_2\text{HPO}_4$ , 0.2% yeast extract and 0.7% acetic acid (pH 5) incubated in a static flask at 30° C; approx. 4 g cellulosic polysaccharide/100 ml medium (wet wt. basis) were produced in pellicle form after 14 days. [See FSTA (1979) 11 2A60.] JA

## 7

Ripening and debittering of cheeses and protein hydrolysates. [Lecture]  
Mälkki, Y.

*International Congress of Food Science & Technology - Abstracts* p.231 (1978) [En] [Food Res. Lab., Tech. Res. Cent. of Finland, Biologinkuja 1, SF-02150 Espoo 15, Finland]

A peptidase preparation from *Pseudomonas fluorescens* [see FSTA (1977) 9 8T481] prevented the development of bitterness in Edam-type cheeses and accelerated the development of typical flavour and texture in Cheddar-type cheeses. Bitter protein hydrolysates lost their bitterness after hydrolysis with *Pseudomonas* peptidase. [See FSTA (1979) 11 2A60.] CDP

## 8

Characteristics of tyrosine phenol-lyase from *Aeromonas phenologenes*.

Carman, G. M.

*Dissertation Abstracts International, B* 37 (10) 4881: Order No. 77-8695 (1977) [En] [Univ. of Massachusetts, Amherst, Massachusetts 01002, USA]

Tyrosine phenol-lyase was obtained from *A. phenologenes*, the organism implicated in phenol production by refrigerated haddock. The enzyme was purified 32 fold and its characteristics were studied. It was found to catalyse conversion of L-tyrosine to phenol, pyruvate and  $\text{NH}_3$  in the presence of added pyridoxal phosphate. The enzyme was inactivated at temp. > 40° C, had a pH optimum of 8.5 and was competitively inhibited by L-alanine and L-phenylalanine. JA

## 9

A study of bacteria contaminating refrigerated cooked chicken; their spoilage potential and possible origin.

Toule, G.; Murphy, O.

*Journal of Hygiene* 81 (2) 161-169 (1978) [10 ref. En] [Dep. of Microbiol., Univ. of Surrey, Guildford, UK]

Cooked chicken samples were divided into 3 portions: (i) allowed to spoil in a normal kitchen refrigerator (variable temp.); (ii) allowed to spoil at a standard 4° C and (iii) removed for biological examination immediately after cooking. After 10 days storage, bacteria were isolated from (i) and (ii). Counts of bacteria isolated from (iii) were low,  $10^2$ - $10^3$  organisms/g. Flora isolated in high numbers from (i) included *Pseudomonas putida* ( $2.1 \times 10^7$ /g), *Ps. fluorescens* ( $6.7 \times 10^7$ /g), and *Aeromonas hydrophila* ( $2.8 \times 10^7$ /g). Flora isolated in high numbers from (ii) were *Ps. putida* ( $4.2 \times 10^6$ /g), *A. hydrophila* ( $6.0 \times 10^6$ /g) and *Corynebacterium* sp. ( $4.6 \times 10^5$ /g). Swabs taken from the kitchen isolated the following bacteria, *Ps. fluorescens*, *Flavobacterium* sp., *Bacillus* sp., *A. hydrophila*, *Proteus* sp., *Ps. putida*, *Arthrobacter* sp. and *Microbacterium thermosphactum*. When pure cultures of organisms isolated from spoiled chickens were inoculated into sterile cooked chickens and held at 4° C, the main spoilage organisms were *Ps. putida* and *A. hydrophila*, which were also isolated from the refrigerator where chickens were stored in the kitchen. *A. hydrophila* was found in significantly high numbers on plates, cutting knives, chopping boards and cold water taps. It was concluded that if *Aeromonas* and *Pseudomonas* could be eliminated from the environment, rapid spoilage of cooked chicken could be prevented, and its shelf life might be extended. SP

## 10

[Kefir micro-organisms: acetic acid bacteria.]

Rosi, J.

*Scienza e Tecnica Lattiero-Casearia* 29 (4) 221-227 (1978) [11 ref. It, en] [Istituto di Microbiol. Lattiero-Casearia, Univ., Perugia, Italy]

96 cultures of catalase-positive, Gram-negative aerobic bacteria were isolated from the liquid kefir and the kefir grains described in the preceding abstr.; 12 cultures, which did not oxidize ethanol to acetic acid at pH 4.5, were classed as *Pseudomonas* spp. The remaining 84 cultures were identified as *Acetobacter aceti*, although 24 of them produced gluconic acid (a parameter which, according to some authors, is characteristic of *Gluconobacter* spp.). Of the 84 cultures, 30 were isolated from the grains and 54 from the liquid kefir. Counts were about 1000/ml in the liquid kefir and 100/g in the grains. ADL

## 11

Effect of potassium sorbate on the growth of *Pseudomonas fluorescens*.

Robach, M. C.

*Journal of Food Science* 43 (6) 1886-1887 (1978) [9 ref. En] [Monsanto Co., 800 N. Lindbergh Boulevard, St. Louis, Missouri 63166, USA]

2 strains of *Pseudomonas fluorescens* were grown in trypticase soy broth (TSB; pH 5.5 and 6.0) at 24° C with or without potassium sorbate. Potassium sorbate was more effective in inhibiting the growth of both strains in the pH 5.5 TSB than in the pH 6.0 TSB. The addition of 0.05% sorbate inhibited the growth of both strains in the pH 5.5 medium, and 0.20% sorbate delayed the growth of both strains in the pH 6.0 TSB. IFT



## 12

**Single cell protein.**

Yissum Research &amp; Development Co.

*British Patent* 1 519 200 (1978) [En]

A process is described in which single cell protein is produced by cultivating a *Pseudomonas* microorganism in a methanolic culture medium containing Cu using formaldehyde or a formate as the single C source. Highest yields were obtained at 35–38° C at pH 5–8. IFT

## 13

**A selective medium for the rapid isolation of pseudomonads associated with poultry meat spoilage.**

Mead, G. C.; Adams, B. W.

*British Poultry Science* 18 (6) 661–670 (1977) [26 ref. En] [Food Res. Inst., Colney Lane, Norwich NR4 7UA, UK]

A new selective medium (CFC) has been developed for the rapid isolation of pigmented and non-pigmented pseudomonads associated with the spoilage of poultry meat held under chill conditions. It comprises Difco Heart Infusion Agar supplemented with 50 µg cephaloridine, 10 µg fucidin and 10 µg cetrimide/ml. CFC medium was found to be more selective than 3 other media which have been used for isolating pseudomonads from foods, when tested with pure cultures of 28 reference organisms. CFC supported the growth of a higher proportion of pseudomonads from freshly-eviscerated carcasses and processing equipment when the organisms were present only in low numbers relative to other genera. AS

## 14

**Ethylene and agriculture: the role of the microbe.**

[Review]

Primrose, S. B.

*Journal of Applied Bacteriology* 46 (1) 1–25 (1979) [98 ref. En] [Dep. of Biol. Sci., Univ. of Warwick, Coventry CV4 7AL, UK]

This review of ethylene synthesis and oxidation by microorganisms includes discussion of the role of ethylene and plant disease, particularly early ripening of bananas associated with *Pseudomonas solanacearum* infection, and the role of *Erwinia carotovora* in ethylene production by cauliflower florets. The view is advanced that all aerobic heterotrophic microorganisms are able to synthesize ethylene from methionine, and that the role of microbial ethylene production in plant disease should be investigated by the use of mutant microorganisms impaired in ethylene biosynthesis. DIH

## 15

**[Occurrence, detection and significance of *Pseudomonas aeruginosa* in raw milk and in the environment of dairy cattle.]** Vorkommen, Nachweis und Bedeutung von *Ps. aeruginosa* in Rohmilch und in der Umgebung von Milchtieren.

Otte, L.; Hahn, G.; Tolle, A.

*Milchwissenschaft* 33 (12) 737–739 (1978) [11 ref. De, en] [Inst. für Hygiene der Bundesanstalt für Milchwissenschaft, Kiel, Federal Republic of Germany]

*Pseudomonas aeruginosa* was isolated on average from 34.7% of raw milk samples. Examination of 985 samples taken from the cowshed environment showed that heavy contamination was found in the milk collecting jars and the teatcups, both before and after milking. This points to ineffective cleaning. The organism was isolated from 3 of 19 swabs from milker's hands. Heavy contamination was also found in moist areas of the cow's body (udder, teat) as well as in the drinking bowls, feeds and faeces, and on the floors. As *Ps. aeruginosa* is destroyed by HTST pasteurization, it is suggested that raw milk should be pasteurized before consumption. ASe

## 16

**[Role of *Pseudomonas* bacterium in a failure in Maroilles cheese manufacture.]**

Schmidt, J. L.

*Revue Laitiere Francaise* No. 369, 725–726 (1978) [3 ref. Fr] [INRA, Paris-Grignon, 78850 Thiverval-Grignon, France]

A defect of Maroilles cheese, characterized by an oily appearance and putrid smell, was attributed to excessive surface growth of psychrotrophic organisms, notably *Pseudomonas maltophilia*. The defect was reproduced by inoculating the curd with *Ps. maltophilia* during Maroilles cheese manufacture. CDP

## 17

**Purification and some characteristics of pectate lyase from *Pseudomonas fluorescens* GK-5.**

Rombouts, F. M.; Spaansen, C. H.; Visser, J.; Pilnik, W.

*Journal of Food Biochemistry* 2 (1) 1–22 (1978) [48 ref. En] [Dep. of Food Sci. & Genetics, Agric. Univ., Wageningen, Netherlands]

*Pseudomonas fluorescens* GK-5 produced  $\leq 35$  units/ml of a single extracellular pectate lyase in a gluconate-yeast extract medium. The enzyme was purified by chromatography on CM Bio-Gel A at pH 7.0, and on crosslinked pectate, 1st at pH 7.0 and then at pH 9.0. The pure enzyme (specific activity 956 units/mg protein) has a mol. wt. of 42 300 and an isoelectric point of 10.3. Its amino acid composition was determined. The pectate lyase is an endo enzyme, requiring  $\text{Ca}^{2+}$  for its activity. The enzyme is maximally active at pH 9.4 and ionic strength 0.01. It has a  $K_m$  value of 0.10 mg polygalacturonic acid/ml and a  $V_{max}$  of 1.3 mmol unsaturated products released/min mg enzyme protein. The organism produces soft rot in potato. The enzyme macerates potato tissue optimally at about pH 8. Cell-bound pectate lyase was also found. Molecular and kinetic properties of the cell-bound enzyme are identical to those of the extracellular enzyme. AS

## 18

**Histology of cowpea plant infected with *Xanthomonas vignicola*.**

Shekhawat, G. S.; Patel, P. N.; Raj, S.

*Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz* 84 (9) 547–558 (1977) [21 ref. En, de] [Indian Agric. Res. Inst. New Delhi, India]

Histological and histochemical changes in the leaf, stem and seeds of cowpeas infected with *X. vignicola* were studied and shown in photomicrographs. In



invaded tissues, pectic substances and starch were degraded, free  $\alpha$ -amino groups increased, but cellulose remained intact. RM

## 19

**A scanning electron microscope study of bacterial invasion in hen's egg shell.**

Tung, M. A.; Garland, M. R.; Gill, P. K.

*Canadian Institute of Food Science and Technology Journal* 12 (1) 16-22 (1979) [24 ref. En, fr] [Dep. of Food Sci., Univ. of British Columbia, Vancouver, British Columbia, Canada V6T 1W5]

Fresh hen's eggs were immersed in a suspension of *Pseudomonas fluorescens*. After 3, 4, 7 and 11 days eggs were removed and shell samples examined by scanning electron microscopy. No bacterial invasion of the shell pores was evident after 3 days exposure to the microorganism, confirming the protective role of the cuticle in closing pores through the calcareous layers. Pores of eggs exposed for 4, 7 and 11 days were infected with *P. fluorescens*. The cuticular barrier was apparently overcome by a digestive process. Invasion of the pores and shell membranes then proceeded very rapidly. Bacteria were found throughout the shell membrane fibre interstices with no particular accumulation at the continuous inner boundary of the inner shell membrane. The appearance of the fibres and the inner boundary was entirely unchanged after infection which suggested an enzymic process was not involved in the breaching of the final barrier protecting the eggs' contents. AS

## 20

**Purification and properties of particulate alcohol dehydrogenase from *Acetobacter aceti*.**

Adachi, O.; Miyagawa, E.; Shinagawa, E.; Matsushita, K.; Ameyama, M.

*Agricultural and Biological Chemistry* 42 (12) 2331-2340 (1978) [28 ref. En] [Dep. of Agric. Chem., Fac. of Agric., Yamaguchi Univ., Yamaguchi 753, Japan]

Particulate alcohol dehydrogenase of acetic acid bacteria was purified to homogeneity from *Acetobacter aceti* IFO 3284. The enzyme was purified about 70  $\times$  with an overall yield of 55% from the cell homogenate by solubilization and extraction of the enzyme with Triton X-100 and subsequent fractionations on column chromatography. The purified enzyme was revealed to be a flavo-cytochrome complex and was composed of 4 different subunits having mol. wt. of 63 000, 44 000, 29 000 and 13 500. A tightly bound cytochrome component was not alcohol dehydrogenase itself and had a function as an electron acceptor in vivo. The 1st subunit, which reacts with ethanol, was shown to be a flavoprotein of the particulate alcohol dehydrogenase complex. Catalytic properties of the enzyme were also examined, and the data show that the enzyme could be responsible for vinegar fermentation. AS

## 21

**[Classification of acetic acid bacteria and flavour of vinegars.] [Review]**

Yanagida, F.

*Journal of the Society of Brewing, Japan [Nihon Jozo Kyokai Zasshi]* 73 (6) 436-440 (1978) [22 ref. Ja]

[Tokyo Univ. Agric., Setagaya-ku, Tokyo, Japan]

Classification of *Acetobacter* useful for vinegar production, based on vitamin requirements and organic acids assimilation; flavour components of vinegars, including amino acids and acetoin; and improvement of vinegar making methods are reviewed. YN

## 22

**The effect of the psychrotrophic organisms and the age of the milk on the production of acetaldehyde and diacetyl in cultured buttermilk.**

Haukka, J. J.; Harper, W. J.

*Meijeritieteellinen Aikakauskirja* 36, 1-10 (1978) [En] [Dep. of Food Sci. & Nutr., Ohio Agric. Res. & Development Cent., Columbus, Ohio 43210, USA]

*Pseudomonas fragi* was added to pasteurized skim-milk, which was then stored for 5 days at 5°C. Portions from the inoculated skim-milk and from control skim milk without *P. fragi* were taken after 2, 3, 4 and 5 days for cultured buttermilk manufacture. It was found that acetaldehyde content of buttermilk increased (but diacetyl content remained the same) with increasing age of milk. Buttermilk made from skim-milk in which *P. fragi* counts reached high levels of  $2.0 \times 10^8$ – $3.5 \times 10^9$ /ml (after 4-5 days) had significantly lower diacetyl (1.6 p.p.m.) and acetaldehyde (1.3 p.p.m.) contents than the control buttermilk (2.3 p.p.m. of each). The growth of *P. fragi* did not affect the relative proportions of the 2 compounds, however. Since *P. fragi* was destroyed by heat treatment before inoculation with the buttermilk culture, it appeared that the metabolism of the latter culture was influenced by heat-resistant enzymes or metabolites from *P. fragi*. ADL

## 23

**[Resistance of bacteria responsible for food poisoning, and isolated from foods of marine origin, to low temperatures.]**

Lhuillier, M.; Coulanges, P.; Pagesy, H.; Feliste, J.

*Nouvelle Presse Medicale* 6 (19) 1660 (1977) [4 ref. Fr] [Inst. Pasteur de Madagascar, BP 1274, Tananarive, Madagascar]

To determine the low-temp. resistance of *Vibrio parahaemolyticus* and *Pseudomonas putrefaciens* (previously shown to have been isolated from the stools of persons with diarrhoea), 22 samples of oysters and shellfish, 22 fish and 20 prawns were held at -18°C for 210 days, and then examined for presence of the 2 microorganisms. Numbers of strains of *V. parahaemolyticus* isolated were 18, 19 and 18, resp.; corresponding numbers for *P. putrefaciens* were 13, 5 and 8. Thus, both microorganisms had pronounced low temp. resistance, particularly *V. parahaemolyticus* (probably attributable to its halophilic properties). 30 pure strains of the microorganisms were also studied, but no results are given. KME

## 24

**Enzymatic degradation of beef by *Pseudomonas fragi*.**

Balasundram, K.

*Dissertation Abstracts International, B* 38 (10) 4712-4713; Order no. 78-03693, 163pp. (1978) [En] [Univ. of Missouri-Columbia, Columbia, Missouri 65201, USA]



Studies on effects of *Pseudomonas fragi* (ATCC 4973) and its enzymes on the colour stability of beef and aqueous beef extract and on the lipids and proteins of beef are described. *P. fragi* had a detrimental effect on the colour, pH and free fatty acid values of beef stored at  $1 \pm 1^\circ\text{C}$ ; both proteolytic and lipolytic degradation products decreased colour stability. Oxymyoglobin concn. was lower in beef extract inoculated with *P. fragi* than in sterile beef extract; after 10 days there was a 76% loss of oxymyoglobin in the inoculated samples, vs. 45% in sterile controls. Growth of *P. fragi* caused significant changes in the electrophoretic patterns of water-soluble beef proteins. Endocellular enzymes of *P. fragi* adversely affected beef colour; no lipoxygenase activity was, however, detected. Extracellular protease and lipase activity was detected, and was also responsible for colour deterioration of beef. 'Warm white' fluorescent light (120 foot candles) had a significant detrimental effect on meat extract colour stability: during storage for 26 days at  $1^\circ\text{C}$ , all oxymyoglobin was lost from samples illuminated for 12 h/day, whereas only 60% was lost from samples stored in the dark. AJDW

## 25

[Biochemical changes in fish flesh caused by *Pseudomonas fluorescens*.]

Stanczak, B.

*Zeszyty Naukowe Szkoły Główniej Gospodarstwa Wiejskiego Akademii Rolniczej w Warszawie, Weterynaria* No. 7, 21-32 (1977) [15 ref. Pl, ru, en]

[Katedra Higieny Produktów Zwierzęcych, SGGW-AR, Warsaw, Poland]

Lateral muscles of carp taken 1 h after killing were cut into slices about 3 cm wide, and experimental and control slices were treated, and the results were reported, exactly as described in FSTA (1979) for beef, except that samples were stored for 10 days at  $0^\circ$  and at  $4^\circ\text{C}$  and examined initially and after 3, 5, 7 and 10 days; or for 3 days at  $20^\circ\text{C}$  and examined daily. pH changed little at  $0^\circ$  and  $4^\circ\text{C}$ , but increased appreciably at  $20^\circ\text{C}$ . Concn. of ammonia N did not change significantly in the contaminated samples, but content of amino N increased. Organoleptic changes began appearing in the contaminated samples when bacterial content reached  $10^7/\text{g}$ , on the 7th day at  $0^\circ\text{C}$ , on the 4th day at  $4^\circ\text{C}$ , and on the 1st day at  $20^\circ\text{C}$ . [See FSTA (1979) 11 12S1889.] SKK

## 26

[Biochemical changes in beef caused by *Pseudomonas fluorescens*.]

Stanczak, B.

*Zeszyty Naukowe Szkoły Główniej Gospodarstwa Wiejskiego Akademii Rolniczej w Warszawie, Weterynaria* No. 7, 7-20 (1977) [26 ref. Pl, ru, en]

[Katedra Higieny Produktów Zwierzęcych, SGGW-AR, Warsaw, Poland]

Beef sirloins from young cattle taken 2-3 h after slaughter were cut into slices 2-3 cm thick; 4 ml diluted broth culture of museum strain No 107 of *Pseudomonas fluorescens* from the collection of the State Institute of Hygiene in Warsaw, containing on average  $7.57 \times 10^5$

cells [ $?/\text{ml}$ ] were distributed on the surface of each experimental slice, 4 ml sterile physiological saline being similarly applied to control slices. Both types were left at room temp. for 20 min to allow liquid absorption and were then stored in separate sterile metal cans at  $4^\circ\text{C}$  for 15 days or at  $20^\circ\text{C}$  for 4 days. Mean values with confidence limits are tabulated for pH of extract, and contents of ammonia N and amino N of samples examined initially and after storage for 4, 10 and 15 days at  $4^\circ\text{C}$ , and for 1, 2, 3 and 4 days at  $20^\circ\text{C}$ . Logarithms of numbers of bacteria/g sample are also presented; and results of organoleptic examination for colour, odour, consistency and surface appearance are discussed. Chemical and organoleptic changes become evident in contaminated samples on the 2nd day at  $20^\circ\text{C}$  and on the 10th at  $4^\circ\text{C}$ , the 1st signs of organoleptic deterioration appearing when bacterial counts reached  $10^7/\text{g}$ . [See FSTA (1979) 11 12R737.] SKK

## 27

Influence of potassium sorbate on growth of *Pseudomonas putrefaciens*.

Robach, M. C.

*Journal of Food Protection* 42 (4) 312-313 (1979)

[8 ref. En] [Monsanto Co., 800 N. Lindbergh Boulevard, St Louis, Missouri 63166, USA]

Effect of potassium sorbate on growth of 2 strains of *P. putrefaciens* (*Alteromonas*) was studied. Addition of 0.2% sorbate to trypticase soy broth (pH 6.0, i.e. near that of fresh poultry) inactivated strain P19X and resulted in a 3-log cycle reduction in number of viable cells of strain P5LIN after 6 days incubation at  $24^\circ\text{C}$ . AS



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FAB 43

PSEUDOMONADACEAE AND FOOD PROCESSING

SELECTED FROM VOLUME **12**

FOOD SCIENCE AND TECHNOLOGY ABSTRACTS

**under the direction of**

Commonwealth Agricultural Bureaux, Farnham Royal, Bucks; Gesellschaft für Information und Dokumentation, Frankfurt am Main; Institute of Food Technologists, Chicago; Centrum voor Landbouwpublikaties en Landbouwdocumentatie (Pudoc), Wageningen.



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Some of the larger FABs have been divided into sections to facilitate use. FAB 47 also has a subject and author index provided.

Copies of all original articles referred to in the abstracts may be bought ( or occasionally borrowed) from the International Food Information Service. A form for ordering these is provided at the end of this FAB.

Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES

EDITOR





## 1

**Role of *Hafnia alvei* and a *Lactobacillus* species in the spoilage of vacuum-packaged strip loin steaks.** Hanna, M. O.; Smith, G. C.; Hall, L. C.; Vanderzant, C. *Journal of Food Protection* 42 (7) 569-571 (1979) [10 ref. En] [Dep. of Anim. Sci., Texas Agric. Exp. Sta., Texas A&M Univ., College Station, Texas 77843, USA]

A microbiological examination of vacuum-packaged strip loin steaks that were defective (gassy packages,  $H_2S$  odour) revealed high total counts ( $10^7$ - $10^8$ /cm<sup>2</sup>) with *Hafnia alvei*, *Lactobacillus* and *Pseudomonas* spp. as major isolates. Re-inoculation experiments indicated that *H. alvei* was the likely cause of the  $H_2S$  odour. Gas formation resulted from the activity of heterofermentative lactobacilli and *H. alvei*. Improvements in plant practices and temp. control eliminated the problem. AS

## 2

**[Occurrence of certain species of Gram-negative bacteria from the genera *Yersinia*, *Klebsiella* and *Aeromonas*, and their role in the aetiology of food poisoning.]** [Review] Maciejaska-Roczan, K.

*Roczniki Panstwowego Zakladu Higieny* 30 (3) 217-223 (1979) [47 ref. Pl, en] [Zaklad Badania Zywnosci i Przedmiotow Uzytku Panstwowego Zakladu Higieny, Warsaw, Poland]

On the basis of a survey of the literature, the authors contend that bacteriological analysis of food suspected of causing gastrointestinal disturbances should be extended to include *Y. enterocolitica*, *K. pneumoniae* and *A. hydrophila*. [From En summ.] HBr

## 3

**Heat-resistant proteolytic enzymes from *Pseudomonas* in milk: studies on thermal stability.** Barach, J. T.

*Dissertation Abstracts International*, B 38 (7) 3109-3110: Order no. 77-29619, 107pp. (1978) [En] [N. Carolina State Univ., Raleigh, N. Carolina 27607, USA]

Extracellular proteolytic bacterial enzymes present in most raw milk supplies were not fully inactivated by UHT treatment (149°C for 10 s), and defects in commercial sterilized milk were identical to those induced by addition of proteinase. The heat-resistant proteinase of *Pseudomonas fluorescens* strain MC60 contained  $Ca^{++}$  and  $Zn^{++}$ , normally both present in milk in adequate concn. to allow heat stability ( $Ca^{++}$ ) and re-activation ( $Zn^{++}$ ) of the enzyme. The proteinase was inactivated by metal-complexing agents or by low temp. heat-treatment of milk (60 min at 55°C), which caused formation of an enzyme-casein complex, thus reducing enzyme activity by 60%. MEG

## 4

**Effect of carbon dioxide on growth of *Pseudomonas fluorescens*.**

Gill, C. O.; Tan, K. H. *Applied and Environmental Microbiology* 38 (2) 237-240 (1979) [12 ref. En] [Meat Ind. Res. Inst. of New Zealand (Inc.), Hamilton, New Zealand]

In minimal medium at 30°C, growth of *P. fluorescens*,

a major food spoilage organism, was stimulated when the pressure (p) of  $CO_2$  in solution was 100 mm of Hg, but at higher concn. the growth rate declined linearly with increasing  $pCO_2$ . All concn. of  $CO_2$  were inhibitory for growth in complex medium, and at 30°C the max. degree of inhibition was attained when  $pCO_2$  was 250 mm Hg. The degree of inhibition at a constant  $pCO_2$  in solution increased with decreasing temp. Degree of inhibition was directly proportional to temp. for growth in complex medium, but not in minimal medium. Inhibition of cell respiration by  $CO_2$  was the same whether cells had been grown in air or in the presence of  $CO_2$ , indicating that adaptive enzyme synthesis does not occur in response to  $CO_2$ . AS

## 5

**Nutritional studies on xanthan production of *Xanthomonas campestris* NRRL B1459.**

Souw, P.; Demain, A. L. *Applied and Environmental Microbiology* 37 (6) 1186-1192 (1979) [13 ref. En] [Dep. of Nutr. & Food Sci., Massachusetts Inst. of Tech., Cambridge, Massachusetts 02139, USA]

The nutritional requirements of *Xanthomonas campestris* NRRL B1459 for optimal xanthan production were studied in a chemically defined medium. Of the carbon sources tested, a 4% sucrose or glucose medium yielded the highest xanthan titres. The further addition of certain organic acids, such as succinate, pyruvate, and  $\alpha$ -ketoglutarate, stimulated xanthan production, excess concn. of these acids inhibited xanthan formation. Certain amino acids (e.g. glutamate) and nitrate salts were superior to ammonium salts for xanthan production. Concn. of these N sources higher than the optimal levels inhibited xanthan production while stimulating growth. Xanthan production was also sensitive to high concn. of inorganic phosphate. High xanthan potencies, up to 30 g/kg of broth, were achieved in these shake-flask studies, in which completely defined media were used. AS

## 6

**Biochemical and toxigenic characterization of motile *Aeromonas* isolated from fish.**

Olivier, G.; Lallier, R.; Lariviere, S. *Abstracts of the Annual Meeting of the American Society for Microbiology* 79, 99 (1979) [En] [Fac. of Vet. Med., Univ. of Montreal, St. Hyacinthe, Quebec H3C 3G1, Canada]

132 strains of motile *Aeromonas* isolated from fish, humans, mammals, water and food were biochemically characterized. Based on Popoff & Veron's (1976) classification they were identified as *A. hydrophila* sp. or *A. sobria* sp.; strains of *A. hydrophila* hydrolysed esculin, and fermented arabinose and salicine while *A. sobria* strains did not. Lesions and kidneys of diseased fish yielded *A. hydrophila* only whereas both *A. hydrophila* and *A. sobria* were isolated from the intestines of healthy and diseased fish. Auxanogram and toxigenic profile of 40 fish isolated were compared. 30 substrates were tested with the auxanogram technique: 4 of these C sources, arabinose, salicine, pyruvate and L- $\alpha$ -alanine were utilized by *A. hydrophila* strains only. Significant differences between these spp.



were observed when their toxigenic profiles were compared which included: production of haemolysin, protease, dermonecrotic factor and enterotoxin. *A. hydrophila* isolates were generally more toxigenic than *A. sobria* isolates. AS

## 7

**[Taxonomy of *Enterobacteriaceae* and *Pseudomonadaceae* from minced meat.]**

Untersuchungen zur Taxonomie von Enterobakterien und Pseudomonaden aus Hackfleisch.

Kleeberger, A.

*Archiv für Lebensmittelhygiene* 30 (4) 130-137 (1979)

[44 ref. De, en][Süddeutsche Versuchs. &

Forschungsanstalt für Milchwirtschaft, Tech. Univ.

München, D-8301 Weißenstephan, Federal Republic of Germany]

1078 *Enterobacteriaceae* and 915 *Pseudomonadaceae* were isolated from 41 samples of minced meat and tested for 34 and 28 characteristics resp. By numerical methods 10 distinct groups of *Enterobacteriaceae* and 6 of *Pseudomonadaceae* (some closely related) were distinguished. Tabulated results showed the dominating *Enterobacteriaceae* to be *Serratia liquefaciens*, *Citrobacter freundii*, *Erwinia* spp. and *Klebsiella aerogenes*, followed more rarely by *Enterobacter cloacae*, *Escherichia coli*, *Kluyvera I*, *Kluyvera II*, *Enterobacter hafniae* and *Providencia alcalifaciens*. Among *Pseudomonadaceae* the vast majority of strains belonged to *Pseudomonas fragi* which is typical for refrigerated minced meat. Only a few isolates were identified as *Ps. fluorescens*. [From En summ.] RM

## 8

**Identification of *Pseudomonas tolaasi*: the white line in agar and mushroom tissue block rapid pitting tests.**

Wong, W. C.; Preece, T. F.

*Journal of Applied Bacteriology* 47 (3) 401-407 (1979)

[4 ref. En][Dep. of Plant Sci., Univ. of Leeds, Leeds LS2 9JT, UK]

The causative organism of classical bacterial blotch disease of cultivated mushrooms is *Pseudomonas tolaasi*. Symptoms of the disease are dark brown, often wet and sunken lesions on mushroom caps and stalks which render the crop unsaleable. A specific and reliable method for identification of *Ps. tolaasi* is described. A sharply defined white line of precipitate is formed in *Pseudomonas* Agar F (Difco) between the opaque white colonies of *Ps. tolaasi* and translucent colonies of certain unidentified pseudomonads. The white line test was positive when 113 isolates of *Ps. tolaasi* from 5 different countries were examined, whereas 154 isolates of pseudomonads other than *Ps. tolaasi* did not give the white line reaction with a reacting translucent colony pseudomonad. Browning of mushrooms in host tests does not help in identification of *Ps. tolaasi*, but conspicuous pitting in < 10 min at the cut surface of mushroom tissue is as specific as the white line test (and more rapidly performed) in detecting *Ps. tolaasi* in suspension of distilled water. AL

## 9

**A note on microbial growth on hen egg-shells.**

Board, R. G.; Loseby, S.; Miles, V. R.

*British Poultry Science* 20 (4) 413-420 (1979) [21 ref. En][School of Biol. Sci., Univ. of Bath, Bath BA2 7AY, UK]

2 strains of cuticle digesting pseudomonads were isolated from the surface of hens' egg-shells that had been stored in a humid (saturated) atm at 25°C. Digestion was due to a protease, the demonstration of which was only achieved in media containing cuticle. The egg-shells were also colonized by yeasts, but the growth of these organisms appeared to be dependent upon the pseudomonads for the release of nutrients from the cuticle. The pseudomonads would not grow on cuticle in situ unless the RH was about 100%. AS

## 10

**Growth limitation of *Pseudomonas* spp. by glucose.**

Barua, M.; Shelef, L. A.

*Abstracts of the Annual Meeting of the American Society for Microbiology* 79, 215 (1979) [En][Wayne State Univ., Detroit, Michigan 48202, USA]

The effect of glucose on growth of 2 *Shewan's* group II pseudomonads at 5 and 22°C was studied. In the absence of glucose, a growth level of approx.  $10^9$  cells/ml was reached in nutrient broth after approx. 7 days of incubation. It was accompanied by pH elevation, high turbidity, slime formation and off-odours. In the presence of glucose at concn. of 0.5 to 10% by wt, growth lag and growth level were decreased. Total growth was reached after 2-4 days, and its value decreased as the glucose concn. in the medium increased. The medium pH dropped by up to 2 units within the first 2 days of incubation, colony size was small, turbidity was low, and slime and off-odours were absent. Lysis of cells was visible in media with the high carbohydrate concn. Glucose assay showed that the depleted amounts were proportional to the substrate concn. in the medium: at concn. of  $\geq 1\%$  both strains utilized an average of 11.3% of the available glucose, most of it during the first 2 days of incubation. Acid production also increased with increase in glucose concn. Although the effect of glucose lessened in buffered medium of pH 6.3, growth declined in a similar manner with the increase in glucose concn. These results imply possible alteration of the meat spoilage pattern by the addition of glucose. AS

## 11

**Transmissible genetic determinants of *Acetobacter* for thermophilic acetic acid fermentation.**

Beppu, T.; Ohmori, S.

*Abstracts of the Annual Meeting of the American Society for Microbiology* 79, 207 (1979) [En][Univ. of Tokyo, Tokyo, Japan]

Industrial vinegar production has been carried out by continuous acetic acid fermentation from ethanol by *Acetobacter aceti* at about 30°C. A thermophilic strain of *A. aceti* was isolated which enabled continuous vinegar production at 35°C. The strain, No. 1023,



retained full activity to produce acetic acid at 35°C and 50% activity even at 38°C, while usual strains of *A. aceti* completely lost activity at 35°C. Thermophilic property of the strain correlates closely with its resistance to acetic acid (ac<sup>-</sup>). Proline auxotroph of the strain (ac<sup>-</sup>, pro<sup>-</sup>) loses acid-resistance without loss of the pro<sup>-</sup> marker and produces 'cured' strain (ac<sup>+</sup>, pro<sup>-</sup>) with high frequency after the stationary growth phase. Ethanol-oxidizing ability of the strain is also lost with lower frequency. These 'cured' strains showed temp.-sensitivity similar to the usual *A. aceti*. Mixed culture of (ac<sup>-</sup>, pro<sup>-</sup>) and (ac<sup>+</sup>, pro<sup>+</sup>) strains produces recombinant (ac<sup>+</sup>, pro<sup>+</sup>) with almost 80% frequency. Transmissible determinants or plasmids seem to be involved in the thermophilic property of the strain 1023. AS

## 12

Polysaccharide and process for producing same.  
Toyo Soda Manufacturing Co. Ltd.

UK Patent Application 2 019 863A (1979) [En]

Allose-containing polysaccharides are produced by *Pseudomonas viscogena* and are useful as stabilizers and emulsifiers. IFT

## 13

Fermentation studies on solid hydrocarbons utilizing bacterial isolates.

Lonsane, B. K.; Singh, H. D.; Nigam, J. N.; Baruah, J. N. *Indian Journal of Experimental Biology* 17 (11) 1263-1264 (1979) [8 ref. En] [Biochem. Div., Reg. Res. Lab., Jorhat-785 006, India]

Various strains of *Pseudomonas* and *Azotomonas* exhibited linear growth on emulsified, solid hydrocarbons at 37°C; the rate of linear growth increased with the substrate concn. On slack wax, a by-product of solvent dewaxing of lubricating oil, the slow-growing strains of *Azotomonas* showed exponential growth initially, and linear growth thereafter. The use of solid hydrocarbons makes it easy to separate the cells of the microbial biomass from the spent substrate; the higher fermentation temp. also makes refrigeration of the medium unnecessary. A tasteless and odourless final product, which is acceptable as human food, is obtained. CFTRI

## 14

Growth suppression of pseudomonads by glucose utilization.

Barua, M.; Shelef, L. A.

*Journal of Food Science* 45 (2) 349-351 (1980) [En] [Dep. of Family & Consumer Resources, Wayne State Univ., Detroit, Michigan 48202, USA]

Effect of glucose on growth of 2 Shewan's group II pseudomonads was studied. Concn. of 0.5-10% glucose by wt. in nutrient broth effected a decrease in growth lag and growth level. The pH of the growth medium decreased by as much as 2 units within the first 2 days of incubation. Glucose utilization and acid production increased with increase in glucose concn. These results support previous observations in meat of increased carbohydrate utilization and lowered pH, resulting in suppressed bacterial growth and delayed spoilage in the presence of added glucose. IFT

## 15

Whey fermentation.

Friend, B. A.; Shahani, K. M.

*New Zealand Journal of Dairy Science and Technology* 14 (2) 143-152; 153-155 (1979) [23 ref. En] [Dep. of Food Sci. & Tech., Univ. of Nebraska, Lincoln, Nebraska, USA]

This review deals primarily with utilization of whey and whey constituents by alcoholic fermentation (to whey wine and industrial alcohol), by lactic acid fermentation with whey used as the culture medium, and by fermentation to produce food-grade lactic and citric acids, and single cell proteins for animal feeding. In the discussion (pp. 153-155, 4 ref.), manufacture of a flavoured 'pop wine' from whey is discussed, and some comments are made on the production of citric and lactic acids and of carotene by whey fermentation. Gram-negative pseudomonads are suggested as suitable bacteria for converting dairy wastes into cell protein. [See FSTA (1980) 12 7P1195.] MEG

## 16

The factors determining the poor keeping qualities of DFD meat. [Lecture]

Gill, C. O.; Newton, K. G.

*Proceedings of the European Meeting of Meat Research Workers* No. 24, A4:1-A4:5 (1978) [3 ref. En, de, fr, ru] [Meat Ind. Res. Inst. of New Zealand (Inc.), Hamilton, New Zealand]

Beef striploins graded as DFD (dark, firm, dry) were obtained from a local abattoir. Mean pH and glucose contents in *longissimus dorsi*, *multifidus dorsi* and *longissimus costarum* muscles from 18 striploins were, resp.: pH, 5.67, 5.97 and 6.16; and glucose content, 62, 37 and 22 µg/g wet wt.; glucose was absent from all muscles with pH > 6.4, and absent from some muscles with pH as low as 6. Slices of meat of pH 6.3 and devoid of glucose (from the striploins or from mutton of high ultimate pH obtained from sheep exercised to exhaustion before slaughter) were treated with L-lactic acid to reduce pH to 5.6, or with glucose solution to give final glucose concn. of about 100 µg/100 g. These slices and controls were inoculated with fluorescent *Pseudomonas* sp. isolated from spoiled mutton, and incubated at 10°C under humid, aerobic conditions. Spoilage occurred more readily in samples devoid of glucose, irrespective of pH, than in those containing glucose. Glucose content rather than pH is recommended for definition of the DFD condition. [See FSTA (1980) 12 8S1280.] SKK

## 17

[Effects of heat treatment on proteases in foods.]

Über den Einfluss thermischer Behandlung auf Proteasen in Lebensmitteln.

Christophersen, J.

*Zeitschrift für Lebensmittel-Technologie und -Verfahrenstechnik* 31 (2) 43-46 (1980) [23 ref. De]

[Inst. für Allgemeine Lebensmitteltech. & Tech. Biochem., Univ. Hohenheim, 7000 Stuttgart 70, Federal Republic of Germany]

Heat resistance and thermal stimulation or reactivation of endogenous and microbial proteases in



foods is discussed, with reference to literature and experimental data. Graphs are given showing the activity of extracellular proteases of *Pseudomonas putrefaciens* and *Ps. fluorescens*, intracellular protease of *Lactobacillus bulgaricus*, and muscle cathepsin and bovine muscle protease heated under various time/temp. combinations. All these showed appreciable residual activity after heat treatment, and/or reactivation or thermal stimulation phenomena. Heat resistance and reactivation of *Ps. fluorescens* protease were enhanced in the presence of milk. The practical implications of these results for enzymic proteolysis in heat treated foods is discussed, and possible mechanisms of heat resistance and reactivation of proteases are briefly discussed. AJDW

## 18

[Determination of enzymic lipolytic activity of *Pseudomonas fluorescens* by continuous potentiometry at constant pH.]

Bloquel, R.

*Revue Francaise des Corps Gras* 27 (3) 131-135, 143-144 (1980) [38 ref. Fr, de, en, es] [Lab. de Microbiol. Alimentaire ENSAIA-INPL, 32, Rue Sainte Catherine, 54000 Nancy, France]

A quick, accurate and sensitive method for detn. of the lipolytic activity of a cell-free extract of *Pseudomonas fluorescens* is proposed. The activity is determined by continuous potentiometric titration at constant pH using a Tacussel type TT100 instrument. Comparison of activities and reaction rates with olive oil, butter oil, triolein and tributyrin showed the importance of the substrate: short-chain triglycerides (tributyrin) were hydrolysed preferentially (initial reaction rate 100% vs. 25% for olive oil and 19.4% for butter oil). The triglyceride substrates were emulsified by ultrasonic treatment, avoiding the use of emulsifiers. Lipolysis was enhanced by  $\text{Ca}^{2+}$  ions in this buffer. The zero order reaction is linear for 10 min and proportional to the enzyme concn. The max. error is  $\pm 0.1 \mu\text{mol ml}^{-1} \text{min}^{-1}$ . RM

## 19

The occurrence and significance of *Pseudomonas* in Wiltshire bacon brines.

Gardner, G. A.

*Journal of Applied Bacteriology* 48 (1) 69-74 (1980) [20 ref. En] [Ulster Curers' Ass., 2 Greenwood Avenue, Belfast BT4 3JL, UK]

*Pseudomonas* spp. in Wiltshire bacon cover brines taken from 7 bacon factories were enumerated at regular intervals over 6 months. There were differences between factories as assessed by the geometric mean counts ( $12-2907/\text{ml}$ ) or by the % of samples exceeding  $10^3/\text{ml}$  (0-75%). Heavy pseudomonad contamination of brines was associated with large populations of *Pseudomonas* spp. on fresh pork carcasses and vice versa. The curing of defrosted pork carcasses also led to high *Pseudomonas* spp. counts in brines. The average time for 90% reduction in a *Pseudomonas* population in brine was 35 days. These data can aid interpretation of the *Pseudomonas* count of brines when it is used as a part of microbiological quality control. A set of advisory standards is proposed. AS

## 20

Inhibition of growth and uptake processes in bacteria by some chemical food preservatives.

Eklund, T.

*Journal of Applied Bacteriology* 48 (3) 423-432 (1980) [18 ref. En] [Norwegian Food Res. Inst., PO Box 50, N-1432 As-NLH, Norway]

The effect on growth and uptake processes of some common chemical food preservatives [benzoate, sorbate, propionate and alkyl esters of *p*-hydroxybenzoic acid (parabens)] was studied in strains of *Escherichia coli*, *Bacillus subtilis* and *Pseudomonas aeruginosa*. For parabens, the inhibitory action on growth and amino acid uptake in whole cells and bacterial membrane vesicles followed similar dose-response curves. Growth inhibition caused by parabens appears to be a consequence of transport inhibition. For benzoate, sorbate and propionate, uptake inhibition seems inadequate to explain growth inhibition. AS

## 21

Hot acidified cupric acetate soaks for eradication of *Xanthomonas campestris* from crucifer seeds.

Schaad, N. W.; Gabrielson, R. L.; Mulanax, M. W.

*Applied and Environmental Microbiology* 39 (4) 803-807 (1980) [23 ref. En] [Dep. of Plant Path., Univ. of Georgia, Experiment, Georgia 30212, USA]

Acidified cupric acetate soaks were tested for eradication of *Xanthomonas campestris* from naturally infected crucifer seeds. The pathogen was eradicated from seeds by soaking in 0.5% cupric acetate dissolved in 0.005N acetic acid for 20 min at 35, 40, 45, and 50°C but not 25°C. Moreover, normal bacterial flora of crucifer seeds and the seed-borne *Phoma lingam* and *Alternaria* spp. were reduced by 95, 92, and 81%, resp., after cupric acetate treatment at 40°C. Seed germination % was generally reduced, but the amount depended on treatment temp. and plant cv. The significant reduction in total bacterial flora and seed-borne fungi suggests the usefulness of the treatment for other microorganisms associated with other seeds or foods. AS

## 22

[Characteristics of the proteolytic enzyme system of *Aeromonas hydrophila* LP 50.]

Denis, F.; Veillet-Poncet, L.

*Lait* 60 (595/596) 238-253 (1980) [17 ref. Fr, en] [Lab. de Microbiol. Alimentaire, ENSAIA-INPL, Nancy, France]

Properties of an exocellular proteolytic enzyme from *A. hydrophila*, isolated from packaged pasteurized milk, are described. Endopeptidase activity (using casein as substrate) was max. at pH 8-8.2 at 50°C; when azocasein and denatured haemoglobin were used as substrates, the optimum temp. for EP activity was 40°C and optimum pH 7.5-8.0. Aminopeptidase (AP) activity (with L-leucine-*p*-nitroanilide as substrate) was max. at pH 7.5 and 55°C. AP activity appeared to be more stable to heat than EP activity. The exocellular enzyme system was inhibited by EDTA, phenylmethylsulphonyl fluoride and L-cysteine HCl, indicating that it is a metalloenzyme, and that seryl and sulphur amino acid residues are important for its activity. MEG

[Resistance of Enterobacteriaceae and Pseudomonadaceae in beef and pork to antibiotics and chemotherapeutics.] Antibiotika- und Chemotherapeutika-Resistenz von Enterobacteriaceae and Pseudomonadaceae in Rind- und Schweinefleisch. Reuter, G.; Sasse-Patzer, B.

*Wiener Tierärztliche Monatsschrift* 66 (5) 172-177 (1979) [4 ref. De, en] [Inst. für Lebensmittelhygiene, Fleischhygiene & -tech. der Freien Univ. Berlin, Brümmerstrasse 10, D-1000 Berlin 33]

The % of antibiotic-resistant Enterobacteriaceae and Pseudomonadaceae in beef and pork surface contamination, resistance patterns and transmissible plasmids were studied over several yr. During chilling, cutting and commercial dressing, the % of resistant strains increased in the same proportion as total Enterobacteriaceae counts (a difference of  $\frac{1}{2}$  log cycle was found for pork, 1 log cycle for beef). During cutting, mean counts of resistant Enterobacteriaceae were  $5 \times 10^3/\text{cm}^2$ . Resistance was detected, in decreasing order, against tetracycline, streptomycin, sulphonamides, cephalosporin and ampicillin. The % of strains with R-plasmid isolated from pork was (i) 32% after slaughtering, (ii) 35% during cutting, and 27% in commercial chopped meat. Corresponding numbers for beef were (i) 27% and (ii) 35%, but 47% from around the beef dressing belt. The most common donors were *Klebsiella*, *Escherichia coli*, *Enterobacter*, *Hafnia* and *Proteus* (beef only). R-plasmids were also encountered in *Pseudomonas* and *Acinetobacter* strains recovered from the beef dressing belt. Mostly only one determinant was transferred. Resistance transfer among meat contaminants appeared to be affected more by the environment of the dressing line than by the intestinal flora of the animals. The resistant flora of the operational area was also affected by the human microbial flora. [From En summ.] RM





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SPORES IN FOOD

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H. BROOKES

EDITOR





1

## Germination of spores of *Clostridium perfringens* FD1.

Vaqueiro-Garibay, C.

*Dissertation Abstracts International*, B 40 (9) 4188: Order no. 80-06201, 93pp. (1980) [En] [Michigan State Univ., East Lansing, Michigan 48824, USA]

The effects of (i) heat shock, (ii) pH, (iii) nutrients and (iv) inhibitors in a chemically defined medium, on germination of *Cl. perfringens* FD1 spores were studied. Chemically defined media containing 18 amino acids, glucose, NaCl and dibasic potassium nitrite promoted full germination. Tests for (iii) established alanine, glutamic acid and leucine as most effective agents. Activation by (i) needed 10 min at 80°C. (ii) affected rate and extent of germination markedly, being suitable in defined media at pH values of 5.5-7.0, or on complex media at 5.5-9.0. (iv) needed greater concn. to affect spores than for vegetative cells and if designed for use on aerobic spores (by blocking L-alanine-induced germination) were ineffective against *Cl. perfringens* FD1 spores. The system designed thus also worked for spores of strains ATCC 3624 and NCTC 8238, but not for ATCC 12195 or for *Cl. sporogenes* PA 3679. LH

2

## [Heat stability of *Clostridium botulinum* spores in apricot preserves.]

Rozanova, L. I.; Kuz'menko, R. S.; Nesterova, O. D. *Konservnaya i Qvoshchesushil'naya Promyshlennost'* No. 1, 30-31 (1980) [3 ref. Ru] [Vses. Nauchno-issled. Inst. Konservnoi Promyshlennosti i spetsial'noi Pishchevoi Tekh., USSR]

Stability of *Cl. botulinum* spores to heat was studied in products containing varying amounts of apricot, apple or carrot purees. The spores were able to develop in apricot products at pH > 3.8. Their stability was higher in apricot puree (or in products with a high apricot puree content) than in apple or carrot purees. The heat stability of the spores was nevertheless low in conditions approximating those of industrial processing. STI

3

## Some factors affecting the growth, sporulation and thermal resistance of *Bacillus stearothermophilus*. Yildiz, F.

*Dissertation Abstracts International*, B 40 (3) 1108: Order no. 79-20751, 115pp. (1979) [En] [Univ. of Maryland, College Park, Maryland 20742, USA]

Max. numbers of vegetative cells and spores of *B. stearothermophilus* were obtained in trypticase soy broth, compared with nutrient, glucose tryptone, eugon and sporulation broths. A 0.1% inoculum of stationary phase cells gave the highest growth and sporulation rates. Addition of cystine (0.3 g/l) alone or with Na<sub>2</sub>SO<sub>3</sub> (0.20 g/l) to the broth, or reduction of its glucose content, had minimal effect on growth and sporulation. Results of these and other tests suggest that optimum incubation conditions are at pH 7.1 and 58°C with aeration at a rate of 3000 ml/min. D<sub>250</sub> value of the resulting spores was 3.5 min in milk. The spores would be suitable for thermal death time, inoculated pack and sporocidal efficiency studies. JMa

4

## Relationship between the increased sensitivity of heat injured *Clostridium perfringens* spores to surface active antibiotics and to sodium chloride and sodium nitrite.

Chumney, R. K.; Adams, D. M.

*Journal of Applied Bacteriology* 49 (1) 55-63 (1980) [21 ref. En] [Dep. of Food Sci., N. Carolina State Univ., Raleigh, N. Carolina 27650, USA]

Studies were conducted on inhibition of heat-activated and heat-injured spores of *Clostridium perfringens* NCTC 8798 by NaCl (2.0-4.3%), NaNO<sub>2</sub> (0.02-0.05%) or a mixture of 20 µg polymyxin (PM) and 50 µg neomycin (NM)/ml medium. Data are presented for % recovery of heat activated spores, and spores subjected to heat treatment at 70-100°C, inhibition of heat-injured spores by the agents studied, alone or in combination, and for effects on repair of thermal injury, in the presence of substances inhibiting macromolecular synthesis (nalidixic acid, tetracycline, D-cycloserine). PM/NM, NaCl and NaNO<sub>2</sub> had little effect on colony counts of heat-activated spores, but reduced recovery rate of spores heated at 90°C for 6 h by 78-99%, suggesting that the spores underwent heat damage increasing sensitivity to these agents. Level of inhibition and apparent % of injured spores increased with increasing NaCl or NaNO<sub>2</sub> concn., and increasing temp.

5

## Recovery of *Clostridium botulinum* from mud samples incubated at different temperatures.

Notermans, S.; Dufrenne, J.; Schothorst, M. van *European Journal of Applied Microbiology and Biotechnology* 6 (4) 403-407 (1979) [En] [Lab. for Zoonoses & Food Microbiol., Nat. Inst. of Public Health, PO Box 1, Bilthoven, Netherlands]

Recovery of different types of *C. botulinum* simultaneously present in samples was studied at anaerobic incubation temp. of 20°, 30° or 37°C using mud samples that were naturally contaminated, or those naturally contaminated with type C (drawn from the vicinity of a duck killed by botulism) to which spores of types A, B and E had been added. Samples were incubated in cooked meat medium (with or without an initial heat treatment at 70°C) and toxin types were determined using anti-botulinum serum of the appropriate types. *C. botulinum* type C was recovered at 37°C, but other types were not. Type C was not always recovered at ≤ 30°C, especially in the presence of type E. Type B was recovered equally well at 20° or 30°C, type E was recovered best at 20°C. Type A was only recovered if large numbers of spores were added to samples and only at ≥ 30°C. Use of 2 incubation temp. to determine all types of *C. botulinum* present in samples is recommended. Demonstration of presence of types B and E in samples thought to contain only type C (not associated with human botulism) has implications for human health. DIH



**[Formation of toxins of botulism-producing spores and their heat stability in juice from machine harvested tomatoes.]**

Mordvinova, S. A.; Belousova, M. V.; Titarenko, I. O. *Konservnaya i Ovoshchesushil'naya Promyshlennost'* No. 4, 37-40 (1980) [Ru] [VNIPKI 'Konservpromkompleks', USSR]

Potential growth and formation of toxins in *Clostridium botulinum* type A and B spores in machine harvested tomatoes juice with pH ranging between 4.2 and 4.9 were studied. Calculated coeff. of heat resistance of these spores are given. The F-effect value at all investigated temp. rose substantially as the pH increased. A distinct correlation was found between  $F_{125^\circ\text{C}}$  and pH ( $r = 0.96$ ). At lower temp. (121° and 110°C), a low pH required an appreciable rise in the sterilization effect. STI

## 7

**A comparison of methods for evaluating the shelf-life of pasteurized and repasteurized fluid milk.**

Gillis, W. T.

*Dissertation Abstracts International, B* 40 (2) 660; Order no. 79-18528, 89pp. (1979) [En] [Mississippi State Univ., State College, Mississippi 39762, USA]

Tests on 10 commercial raw milk samples showed that repasteurized samples stored at 7°C for 5-20 days had higher standard plate counts, psychrotrophic counts and proteolytic counts than the same milk which had only been pasteurized once, but differences were not significant. Standard plate count and spore counts during storage correlated with flavour (0.2120 and 0.2066 resp.). Data collected from results of the Hull Test on samples incubated at different temp. and times showed that this test could be used to predict shelf-life of milk. The  $R^2$  for the regression equation calculated from these results was 0.539, higher than that obtained from the Mosley test ( $R^2 = 0.375$ ). MEG

## 8

**[New defect in stirred yoghurt.]**

Driessen, F. M.; Stadhouders, J.

*Zuivelzicht* 72 (37) 754 (1980) [2 ref. Nl] [Nederlands Inst. voor Zuivelonderzoek, Ede, Netherlands]

In the summers of 1979 and 1980 a new defect was frequently found in stirred yoghurt in the Netherlands. Its characteristic features were: slow acidification of milk; occurrence of serum on the coagulum before stirring; lumpy consistency after stirring; and insipid flavour. The defect was due to *Bacillus cereus* spores, which were able to grow in the initial phases of incubation before the yoghurt organisms became dominant. The problem was most likely to occur when the milk contained  $>4$  mg  $\text{O}_2/\text{kg}$ , as under these conditions the *Streptococcus thermophilus* failed to produce the formic acid which *Lactobacillus bulgaricus* needs for good growth [see FSTA (1969) 1 1P127]. The following preventive measures are advocated: use of milk with a low count of *B. cereus* spores; minimizing the  $\text{O}_2$  content of the milk, e.g. by de-aeration if the milk is pasteurized in a closed system where the dissolved  $\text{O}_2$  cannot escape; inoculation of the yoghurt culture into the milk as soon as it enters the incubation tank; and maintenance of the incubation temp. above 31°C. ADL

**[The hygienic risk of commercially sterile canned meat.] Zum hygienischen Risiko bei "Fleisch-Dreiviertelkonserven".**

Prändl, O.

*Archiv für Lebensmittelhygiene* 31 (2) 33-35 (1980) [7 ref. De, en] [Vet. Med. Univ. Wien, Linke Bahngasse 11, A-1030 Vienna III, Austria]

The author discusses the proposed classification of commercially sterile canned meat according to Leistner et al. [*Fleischwirtschaft* (1970) 50, 216], which requires an  $F_s$  value of 0.65-0.80. As spores of *Clostridium botulinum* may survive at these  $F_s$  values, they carry the risk of subsequent germination, proliferation and toxin formation during the proposed 1 yr storage at 15°C. Moreover, the storage temp. is not always maintained. Improving the stability by reducing pH to  $<4.5$  (e.g. acidification of canned aspic sausages) and  $a_w$  to  $<0.95$  (e.g. increased fat and salt addition to canned liver sausage) had much more adverse effect on sensory qualities than higher temp. treatment combined with suitable technological conditions. Stability is further reduced by decreasing  $\text{NO}_2^-$  addition to 70% (1.2-1.4% of nitrite curing salt). Therefore a heat process for canned sausages is recommended which ensures an  $F_s$  value of  $\geq 2.5$  and ensures secure inactivation of *Cl. botulinum* spores. This would allow  $\text{NO}_2^-$  addition to be limited to the min. required for colour and aroma formation (i.e. 50 p.p.m.  $\text{NO}_2^-$  or 1% nitrite curing salt). [From En summ.] RM

## 10

**[Guidelines for testing packaging materials. XXXIX. Determination of bacterial spores in paper, cartonboard, solid board and corrugated board.]**

Merkblätter für die Prüfung von Packmitteln. XXXIX. Bestimmung von Bakteriensporen in Papier, Karton, Vollpappe und Wellpappe.

Anon.

*Verpackungs-Rundschau* 30 (12, Tech.-Wiss. Beil.) 91-93 (1979) [De]

A method is presented for separate detn. of aerobic (*Bacillus*) and anaerobic (*Clostridium*) spore-forming bacteria; sampling methods, necessary equipment, and composition and manufacture of the nutrient media and the phosphate buffer solution are described. For detn. of spore counts, a suspension of the samples (previously reduced to fibres) is heated to 80°C in a water bath to kill off vegetative bacterial cells. This suspension and its 1/100 dilution are incubated for 3 days at 30°C. In detn. of *Clostridium* spores, lysozyme is added to the nutrient medium to suppress growth of potential anaerobic *Bacillus* spp. Only those bacterial spore types which flourish at the incubation temp. can be determined using this method; thermophilic *Bacillus* spores (*B. stearothermophilus*) or spores of *Clostridium thermoaceticum* are not determined. IN



11

The relationship between pH and heat resistance and recovery of bacterial spores.

Brown, K. L.; Thorpe, R. H.

*Technical Memorandum, Campden Food Preservation Research Association* No. 226, 36pp. (1979) [11 ref. En]

Heat resistance studies on *Clostridium sporogenes* were carried out in buffer solutions and tomato puree. A linear z-value was obtained between 105° and 130°C in buffer at pH 7. Inoculated pack experiments were carried out in beans in tomato sauce using spores of *Cl. sporogenes*. Measurement of pH values at high temp. using electrode assembly up to 100°C outside the pressure chamber produced results which agreed with previous data (Tech. Memo 204). However readings, using the pressure chamber to reach high temp., were variable and inconsistent with previous trends. Information is also provided on the effect of pH on heat resistance of bacterial spores and their recovery for *Bacillus stearothermophilus*, *Cl. sporogenes* 3679, *Cl. thermosaccharolyticum*, *B. coagulans* and *Desulfotomaculum nigrificans*. RM

12

Mechanism of nitrite-induced germination of *Clostridium perfringens* spores.

Ando, Y.

*Journal of Applied Bacteriology* 49 (3) 527-535 (1980) [21 ref. En] [Hokkaido Inst. of Public Health, Sapporo 060, Japan]

13

Heat destruction of *Clostridium botulinum* spores and the effect of EDTA thereupon.

Farkas, J.; Grecz, N.

*Acta Alimentaria* 9 (3) 289-301 (1980) [38 ref. En] [Cent. Food Res. Inst., H-1022 Budapest, Herman Otto u 15, Hungary]

Density distribution of spore populations of *Clostridium botulinum* 33A heat treated in the presence and absence of EDTA were determined by centrifugation in Renografin density gradient. In case of heat treatment in EDTA-free medium, density of cells was increasingly shifted towards lower values by increasing heat treatment. Density and refractivity of spores were more drastically reduced by heat treatment in the presence of 0.02 M EDTA than in its absence. Calcium dipicolinic acid (Ca-DPA) was released from spores as the result of heat treatment. In the presence of EDTA, Ca was removed from Ca-DPA, leaving the dipicolinic acid in the free acid form. Furthermore, in the presence of EDTA, the heat resistance of spores was substantially decreased. The observed effects of EDTA are likely to be due to the removal of divalent cations which might play an important role in membrane stability. AS

14

Heat resistance of *Desulfotomaculum nigrificans* spores in soy protein infant formula preparations.

Donnelly, L. S.; Busta, F. F.

*Applied and Environmental Microbiology* 40 (4) 721-725 (1980) [7 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Minnesota, St Paul, Minnesota 55108, USA]

Heat resistance of *Desulfotomaculum nigrificans* spores was determined in soy protein infant formula preparations. Methods of sporulation were developed and evaluated. *D. nigrificans* spores of highest heat resistance were produced in a 40% infusion of spent mushrooms compost. Fraction-negative  $D_{121^{\circ}\text{C}}$ -values obtained in modified soy formula were 25.8 min for spores of ATCC 7946 produced at 55°C and 54.4 min for an isolate designated RGI 1, which was sporulated at 66°C. From the fraction-negative D-values, z-values were obtained of 6.7°C for ATCC 7946 and 9.5°C for RGI 1. Survivor-curve  $D_{121^{\circ}\text{C}}$ -values were 5.6 min for ATCC 7946 and 2.7 min for RGI 1 sporulated at 55°C and heated in modified soy formula. Corresponding  $D_{121^{\circ}\text{C}}$ -values in Butterfield phosphate buffer (pH 7.2) were 3.3 min (ATCC 7946) and 1.1 min (RGI 1). The z-values generated from survivor-curve D-values were similar to those obtained by using fraction-negative procedures. In all instances the inactivation kinetics appeared to be linear. The isolate designated RGI 1, when sporulated at 66°C and heated in a modified infant soy formula, exhibited an extraordinary heat resistance far in excess of previous reports. AS

15

Heat resistance of the chemical resistance forms of *Clostridium botulinum* 62A spores over the water activity range 0 to 0.9.

Alderton, G.; Chen, J. K.; Ito, K. A.

*Applied and Environmental Microbiology* 40 (3) 511-515 (1980) [14 ref. En] [W. Reg. Res. Cent., USDA, Berkeley, California 94710, USA]

Studies were conducted on the heat resistance (at temp.  $\leq 150^{\circ}\text{C}$ ) of 3 resistance forms. i.e. (i) hydrogen form, (ii) untreated form and (iii) calcium form of *Clostridium botulinum* 62A spores at 0.1  $a_w$  intervals over the  $a_w$  range 0-0.9. Tables and graphs are given showing survival, and D and z values. In general, heat resistance was low at  $a_w$  0, increased over the  $a_w$  range 0.1-0.5, decreased sharply over the  $a_w$  range 0.6-0.7, and was low at higher  $a_w$ . Heat inactivation of the spores followed first-order kinetics. (i) showed the lowest and (iii) the highest heat resistance. Practical implications of these results for food processing are briefly considered. AJDW

16

[Food poisoning by *Bacillus cereus*.] [Review]

D'Aubert, S.; Abbati, P.; Cantoni, C.

*Industria Alimentari* 19 (12) 913-921, 926 (1980) [102 ref. It, en] [Istituto di Ispezione degli Alimenti di Origine Anim. Univ. degli Studi, Milan, Italy]



Aspects covered in this review include: characteristics of *B. cereus*, antigen factors, toxin synthesis and release, identification, and pathogenicity. Additionally, a case of food-borne *B. cereus* poisoning (from a chicken dish), including all the analytical stages, is described. HBr

## 17

### Incidence of pathogens and other undesirable bacteria in milk powder.

Lück, H.; Jordaan, I.; Dunkeld, M.

*South African Journal of Dairy Technology* 12 (2) 51-56 (1980) [16 ref. En, af] [Anim. & Dairy Sci. Res. Inst., Irene 1675, South Africa]

Approx. 100 spray-dried skim milk samples from 10 factories were tested for toxinogenic and pathogenic organisms. 30% of samples contained *Staphylococcus aureus* in 0.1 g, but only 2 contained coagulase-positive strains. All samples contained < 10 clostridia/g and < 1 *Clostridium perfringens* and *CL tyrobutyricum*/g. Log coliform count was poorly correlated with log total count ( $r = 0.25$ ), but more closely correlated with log Enterobacteriaceae count ( $r = 0.67$ ); most of the enterobacteria present appeared to be coliforms. No salmonellae were found in 100 g dried skim milk. [See also FSTA (1979) 11 2P317.] CDP

## 18

### Studies on aerobic spore forming bacteria in milk.

Ethiraj, V.; Jayachandran, T.; Krishnamurthi, P. S.; Ramasamy, V.; Narasimhan, R.

*Cheiron* 8 (2) 135-142 (1979) [13 ref. En] [Dep. Dairy Sci., Madras Vet. Coll., Madras 5, India]

Mesophilic (MS) and facultative and obligate thermophilic spore counts in 34 raw milk samples from organized dairy farms averaged 704, 146 and 43/ml resp.; similar counts were obtained after the raw milk samples had been laboratory pasteurized (LP). Corresponding counts for 10 commercially pasteurized milk samples were 1590, 286 and 78/ml. To determine the effects of repasteurization, the LP and commercially pasteurized samples were heated at 80°C for 10 minutes. Keeping quality of the farm milk samples decreased from 18.3-23.3 h after LP to 12.7-15.3 h after reheating, the mean total count and MS count before reheating being 2467-6067 and 300-2267/ml, resp. Keeping quality of commercial samples correspondingly increased from 9.3 h before to 15 h after reheating, the mean total count and MS count before reheating being 17 million and 4633/ml, resp. CDP

## 19

### Heat resistance of *Clostridium botulinum* in acid ingredients and its significance for the safety of chilled foods.

Smelt, J. P. P. M.

*Netherlands Milk and Dairy Journal* 34 (2) 139-142 (1980) [En] [Unilever Res., Vlaardingen, Netherlands]

Sterile neutral dairy products mixed with acid fruit preparations may pose problems because *Clostridium botulinum* spores in the fruit can survive mild heat

treatment and germinate later in the product during chilled storage. This paper (a summary of a thesis at Utrecht University) uses jellified milk with strawberry as an example of this general problem. Using Alderton's medium + 0.04% D-cycloserine, no spores were detected in 90 samples of 25 g strawberry pulp. Heat resistance studies showed that spores of non-proteolytic *C. botulinum* could be adequately eliminated by pasteurization of pulp for 1 min at 95°C (together with the coming-up time, equivalent to 2 min at 90°C), but elimination of spores of proteolytic *C. botulinum* would require heat treatment equivalent to 30 min at 101°C, which would impair fruit quality. Even when inoculated at high level (50 000/ml) into jellified milk with strawberry, however, these spores had long lag phases of 29 days at 15°C and 24 days at 20°C. Analysis of risk in the entire production-distribution chain indicated that satisfactory safety could be attained when viable spore count in the product was  $\leq 10^{-11}$ /portion: it was estimated that the numbers of spores present in the jellified milk after heat treatment for 8 min at 117°C ( $\leq 10^{-27.2}$ ), entering during aseptic filling ( $\leq 1.7 \times 10^{-14}$ ) and present in the chemically sterilized container ( $\leq 10^{-13}$ ) were well below this figure. Moreover, although pasteurization for 1 min at 95°C (+ 2 min at 90°C) only reduced spores of proteolytic *C. botulinum* in fruit pulp to  $1.6 \times 10^{-2}$ /portion, the risk of spores growing out during chilled storage for  $\leq 24$  days was found to be negligible because only 0.36% of products in chilled cabinets were kept above 10°C throughout storage. ADL

## 20

### [Study of psychrotrophic sporeforming bacteria in processed cheeses stored at low temperatures.]

Moiseeva, E. L.; Mishuchkova, L. A.

*Kholodil'naya Tekhnika* No. 8, 36-38 (1980) [6 ref. Ru] [Vses. Nauchno-issled. Inst. Kholodil'noi Promyshlennosti, USSR]

Cold-stored processed cheese was studied for bacterial contamination; samples of psychrotrophic sporeforming bacteria were isolated and studied for their proteolytic and lipolytic properties at low temp.: at 2, 5 and 10°C these bacteria did not multiply but their metabolism could induce changes in proteins and fats which were adverse to quality. All the samples investigated contained bacteria which hydrolysed casein at 2-10°C. STI

## 21

### The effect of potassium sorbate and sodium nitrite on the organoleptic properties, stability, and growth of *Bacillus cereus* and *Clostridium perfringens* in cooked sausage. [Lecture]

Petäjä, E.; Raevuori, M.; Puolanne, E.; Hill, P.

*Proceedings of the European Meeting of Meat Research Workers* No. 25, 12.9:917-12.9:923 (1979) [En, de, fr, ru] [Inst. of Meat Tech., Univ. of Helsinki, Helsinki, Finland]

Effects of potassium sorbate (PS) concn. of 0, 1000 and 2500 mg/kg, and NaNO<sub>2</sub>, concn. of 0, 40, 80 and 150 mg/kg, together with combinations of these, on the flavour, colour and stability of cooked sausages, as well



as on the growth of *B. cereus* and *C. perfringens* in the sausage were studied. The flavour of sausages with 2500 mg/kg PS differed highly significantly from that of sausages containing 0 and 1000 mg/kg for all nitrite concn. PS imparted an unpleasant flavour. With  $\text{NaNO}_2$  concn. of 0 and 40 mg/kg there was no significant difference in flavour between PS concn. of 0 and 1000 mg/kg, but with 80 mg/kg of  $\text{NaNO}_2$  the difference in PS flavour was significant.  $\text{NaNO}_2$  caused a highly significant improvement in flavour for PS levels of 0 and 1000 mg/kg. PS had no effect on the colour of the sausage. In cold storage (+7°C) none of the treatments studied had any significant effect on the total aerobic bacterial count. When the sausage was inoculated with *B. cereus* and *C. perfringens* (approx. 100 spores of each/g),  $\text{NaNO}_2$  had a more pronounced inhibiting effect than PS on the total aerobic bacterial count at 15°C, the counts of these bacteria being lowest in samples containing  $\geq 80$  mg/kg  $\text{NaNO}_2$ . When the sausages were stored at +25°C, PS appeared to restrict growth of total aerobic bacteria more effectively than  $\text{NaNO}_2$ , the inhibition being most pronounced in combinations containing 2500 mg/kg PS. A PS concn. of 1000 mg/kg also appeared to restrict the growth of total aerobic bacteria. The growth of *B. cereus* and *C. perfringens* was considerably inhibited by 150 mg/kg of  $\text{NaNO}_2$  [See FSTA (1981) 13 5S668.] STI

## 22

**Resistance of spores of *Bacillus subtilis* var. *niger* produced from subcultures of spores surviving hydrogen peroxide exposure.**

Wallen, S. E.; Walker, H. W.

*Journal of Food Protection* 43 (7) 528-529 (1980) [11 ref. En] [Dep. of Food Sci. & Tech., Univ. of Nebraska, Lincoln, Nebraska 68583, USA]

Spores of *Bacillus subtilis* subsp. *niger* ATCC 9372, a strain very resistant to  $\text{H}_2\text{O}_2$ , were cultured and exposed to  $\text{H}_2\text{O}_2$  as described previously [FSTA (1979) 11 8B69]. Subculturing of spores that survived exposure to 5%  $\text{H}_2\text{O}_2$  at 50°C for 10 successive generations did not result in either an increase in spore resistance to  $\text{H}_2\text{O}_2$  or an increase or decrease in catalase activity. It is concluded that development of an  $\text{H}_2\text{O}_2$ -resistant spore population is unlikely in food processes in which high levels of  $\text{H}_2\text{O}_2$  are used to sterilize equipment and packaging materials; however, it is considered possible for resistance to  $\text{H}_2\text{O}_2$  to develop in processes where low concn. of  $\text{H}_2\text{O}_2$  are added to reduce bacterial count, e.g. of milk and eggs. CDP

## 23

**[Spores of butyric acid bacteria in milk - a re-emerging problem.]**

Schukking, S.

*Bedrijfsontwikkeling* 9 (5) 417-420 (1978) [2 ref. NI] [Proefstation voor de Rundveehouderij, Lelystad, Netherlands]

Defects in cheese (large eyes and abnormal flavour) due to butyric acid bacteria spores in silage are an old problem in the Netherlands and were the subject of considerable research in the period around the 2nd World War. As a result of this research the problem

was rarely encountered in the period 1960-1975, when silage fed to cows was of good quality and limited in quantity and the dairy industry applied effective measures (addition of 15 g nitrate/100 l milk, etc.) to control the activity of any butyric acid bacteria which did get into the milk. During the 1970s, however, there was a gradual increase in the numbers of butyric acid bacteria spores found in milk: of 1308 cheese milk samples tested in Jan.-May 1976, for example, 56% had 1-7 and 7% had  $>7$  spores/ml. It was thought at first that this was due to increases in average herd size and changes in housing, feeding and milking systems, but investigations failed to show any clear effect of these factors. Further research demonstrated that the source of the spores was pre-dried silage, which (contrary to widely held beliefs) contained large numbers of spores even when dried to  $\geq 50\%$  DM. This was because the silage was not uniformly dry but contained wet patches. Pending further research, the following measures are recommended to counter the problem: rapid, uniform drying of silage, homogeneously mixed; covering of the silage at all times to protect against rain etc.; keeping the silage temp.  $< 20^\circ\text{C}$ ; and meticulous hygiene in milking (in tests spore counts in milk were reduced 10-fold, to 0.25/ml, when udders were washed with a hand spray and dried with a clean paper towel before milking). ADL

## 24

**Preparation of yoghurt.**

Hata, K. (Seikenkai)

*United States Patent* 4 210 672 (1980) [En]

Home production of a cultured milk is facilitated by the use of a special strain of *Bacillus coagulans* spores (*Bacillus* EC-1, Species No. 2930) which are capable of resisting heat treatment at  $100^\circ\text{C}$  for 4 min, germinate very rapidly (3 h) and, being thermobiotic, kill or inhibit undesirable saprophytes. The product is prepared by adding boiling water to a mixture of dried milk and *B. coagulans* spores and fermenting the resultant mixture at  $40-55^\circ\text{C}$  for 7 h. EJM

## 25

**Survival of clostridial spores in animal tissues.**

Gill, C. O.; Penney, N.; Wauters, A. M.

*Applied and Environmental Microbiology* 41 (1) 90-92 (1981) [12 ref. En] [Meat Ind. Res. Inst. of New Zealand, Hamilton, New Zealand]

Spores injected intravenously into mice in numbers  $> 10^2/\text{g}$  of body wt. were initially dispersed to most organs, but after a few days the remaining spores were concentrated in the liver, from which they were eliminated with a half-life of about 6 days. Intraperitoneal injection did not result in contamination of organs unless initial spore numbers exceeded  $10^5/\text{g}$  of body wt., in which case the spores behaved in the same manner as those injected intravenously. Oral administration of spores did not result in any contamination of tissues. This work relates to the health hazard from clostridial spore contamination of meat. For offals intended for human consumption it is said that provided the internal temp. of these organs is reduced within 8 h of death to  $< 15^\circ\text{C}$ , no growth of clostridia can occur and intrinsic spores will not pose any health hazard to the consumer. AL



## 26

Persistence of *Clostridium botulinum* type B on a cattle farm after an outbreak of botulism.

Notermans, S.; Dufrenne, J.; Oosterom, J.  
*Applied and Environmental Microbiology* 41 (1) 179-183 (1981) [11 ref. En] [Lab. for Zoonoses & Food Microbiol., Nat. Inst. of Public Health, 3720 BA Bilthoven, Netherlands]

## 27

Survival of *Clostridium sporogenes* (PA 3679) and *Bacillus coagulans* in green beans and tomatoes home canned at high altitude (7200 ft).

Williams, J. C.; Maki, L. R.  
*Journal of Food Science* 45 (5) 1452-1453 (1980) [8 ref. En] [Div. of Home Economics, Univ. of Wyoming, Laramie, Wyoming 82071, USA]

USDA methods for home canning, adjusted for altitude, served as control for evaluation of survival of *Clostridium sporogenes* (PA 3679) introduced into green bean and *Bacillus coagulans* into tomato packs. Variables included alterations in pressure and length of process time (both greater and less than the control). MPN method was utilized to quantitate growth of organisms before and immediately following heat processing. Growth occurred in the majority of samples processed. Neither control nor variable methods used were adequate for destruction of microorganisms in inoculated packs. USDA recommendations for canning green beans and tomatoes need to be reevaluated. IFT

## 28

[Some problems of methods for sporeformer determination in milk.]

Molska, I.; Bogdanska, H.

*Przegląd Mleczarski* 29 (2) 8-9 (1980) [PI] [Inst. Tech. Żywności, SGGW-AR, 02-528 Warsaw, Poland]

Experiments were carried out to determine whether the commonly used procedures of heat treatment for 10 min at 80 or 85°C are suitable for complete destruction of non-sporulating bacteria in milk and consequent correct detn. of sporeformer counts. 9 batches of bulk cooled raw milk from Warsaw dairy factories were examined. A total of 161 strains were isolated, 83 of them after (i) heating at 80°C for 10 min, and 78 after (ii) heating at 85°C for 10 min; numbers, with % of total in parenthesis, were for sporeformers, non-sporulating rods, and cocci resp.: (i) 31 (37), 20 (24), and 32 (39); and (ii) 62 (79), 16 (21), and 0. It is concluded that more drastic heat treatment is essential for correct detn. of sporeformer count, and 85°C for 15-20 min is suggested. SKK

## 29

Inactivation of bacterial spores in products and on container surfaces. (In 'International conference on UHT processing and aseptic packaging of milk and milk products' [see FSTA (1981) 13 8P1332].) [Lecture] Denny, C. B.; Shafer, B.; Ito, K.  
pp. 82-88 (1980) [7 ref. En] [Nat. Food Processors Ass., Washington, DC, USA]

Development is described of suitable test methods for sterility of UHT milk and milk products, which will enable them to be distributed commercially in the USA as products not requiring refrigeration. Suitable strains of spores have been selected that show the greatest heat resistance in the product during processing, and strains have been selected for determining sterility of containers and closures used in aseptic canning systems,

and sterility within the system especially in filling and closing areas. Methods available for container sterilization include superheated steam, dry hot air, H<sub>2</sub>O<sub>2</sub>, ethylene oxide, and heat sterilization during manufacture of plastics containers: a suitable spore strain must be selected for testing for sterility in each case. CDP

## 30

Effect of nisin on the outgrowth of *Clostridium botulinum* spores.

Scott, V. N.; Taylor, S. L.

*Journal of Food Science* 46 (1) 117-120, 126 (1981) [19 ref. En] [Food Res. Inst, 1925 Willow Drive, Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

Nisin, an antibiotic produced by certain strains of *Streptococcus lactis*, is effective in preventing outgrowth of *Clostridium botulinum* spores. Type A *C. botulinum* spores were the most resistant to the inhibitory action of nisin, requiring 1000-2000 IU nisin/ml for a 50% inhibition of outgrowth on TPYG agar plates. Type E spores were more sensitive, requiring only 50-100 IU/ml for 50% inhibition of outgrowth. Type B spores displayed an intermediate level of sensitivity, requiring 500-1000 IU nisin/ml for 50% inhibition of outgrowth. Similar levels of nisin were necessary to prevent spore outgrowth in TPYG broth and BHI broth over a 7-day incubation period. With prolonged incubation periods of up to 65 days in TPYG broth, spore outgrowth was observed sporadically at higher nisin levels with the type A and B spores which may indicate some decomposition of nisin with storage. Nisin levels of 5000 IU/ml for type A spores and 2000 IU/ml for the type B and Minnesota E spores were insufficient to prevent spore outgrowth by *C. botulinum* in cooked meat medium. For the Beluga E spores, a nisin level of 2000 IU/ml was necessary to prevent spore outgrowth in cooked meat medium. The need for higher levels of nisin in cooked medium to prevent spore outgrowth may be due to the binding of the nisin by meat particles. [See following abstr.] IFT

## 31

Temperature, pH, and spore load effects on the ability of nisin to prevent the outgrowth of *Clostridium botulinum* spores.

Scott, V. N.; Taylor, S. L.

*Journal of Food Science* 46 (1) 121-126 (1981) [9 ref. En] [Food Res. Inst, 1925 Willow Drive, Univ. of Wisconsin, Madison, Wisconsin 53605, USA]

The effectiveness of nisin in preventing the outgrowth of spores of *Clostridium botulinum* types A, B and E in TPYG broth was profoundly affected by pH, temp. of heat-shocking, length of heat-shocking period, and spore load. Nisin was considerably more effective at pH 6 than at either pH 7 or pH 8 in limiting the outgrowth of all 6 tested strains. Heat-damaged spores



were also more sensitive to nisin. Both higher heat-shocking temp. in the range 20–30°C higher than the optimal heat-shocking temp. for the particular strain and longer heat-shocking periods served to lower the levels of nisin required to inhibit spore outgrowth. Nisin was more effective against spore loads of  $10^2$  spores/ml than higher spore loads of  $10^3$  or  $10^4$  spores/ml. With all of these variables taken into consideration, the order of sensitivity of the spores of the various strains of *C. botulinum* was strain 56A < strain 69A < strain 113 B = strain 213 B < strain Beluga E < strain Minnesota E. [See preceding abstr.] IFT

### 32

Comparison of growth response by chemostat cultured and batch cultured *Clostridium perfringens* cells in various food substrates.

Goldner, S. B.; Solberg, M.

*Journal of Food Science* 46 (1) 138–142 (1981) [32 ref. En] [Dep. of Food Sci., Rutgers State Univ., Cook Coll., New Brunswick, New Jersey 08903, USA]

A constant source of exponential phase cells of *C. perfringens* ATCC 3624 could reduce the time required to carry out the protein quality evaluation test of Solberg et al. [see FSTA (1980) 12 2A58] to 4 h. *C. perfringens* ATCC 3624 was grown in an anaerobic chemostat using the chemically defined medium, R&S, with glucose as the growth limiting nutrient. The dilution rate was set at  $0.06 \text{ h}^{-1}$ , the pH at 7.2, and the temp. at 43°C. In the transition from batch to continuous culture, an initial oscillatory cell density response was observed. In the steady state, which was continued for as long as 50 days, the cells were typical Gram-positive rods, occurring singly or in chains as long as 15 rods, which were occasionally without septa. The fermentative and biochemical responses of the cells did not change. No sporulation occurred when the cells were growing in the chemostat, but spores were observed in the glucose-free culture effluent after incubation at 37°C for 24 h. When cells produced in the chemostat were cultured in complex media they demonstrated a growth response similar to cells grown in batch culture. In defined medium (with breaded fish, beef stew or chicken as N source), the generation time for the chemostat cultured cells decreased by approx. 17%. The chemostat cultured cells can be used as inoculum for the *C. perfringens* protein quality assay. IFT

### 33

[Anaerobic spore-forming bacteria in milk.]

Jorgensen, K.

*Nordisk Mejeriindustri* 8 (2) 61–62 (1981) [Da]

Anaerobic spore counts were determined in milk samples obtained monthly from tankers, silo tanks and cheese vats of 47 Danish cheese factories in the 12 months from March 1979. Counts were lowest in June and highest in March. They did not increase during storage at the factory. Analysis of different types of feedstuff throughout the yr revealed that silage (especially grass silage, with an average of 59 000 spores/100 g) was a major source of spores in milk. 10 farms with low spore counts in milk (Group A) and 10 farms with high spore counts (Group B) were selected for special study. In Oct.–Nov., in Groups A and B, resp., mean spore counts were: 400 and 1900/l milk; 33 000 and 40 000/100 g manure; 6300 and 17 600 in 10-ml

swabs from unwashed udders; and 1900 and 9400 in swabs from udders washed for milking. Corresponding counts in March were: 500 and 3600/l milk; 48 000 and 103 000/100 g manure; 22 400 and 60 800 in swabs from unwashed udders; and 7000 and 39 200 in swabs from washed udders. No spores were detected in milking machines. Teat dipping with an iodophor after milking had no effect on spore counts on udders or in milk. Spore counts in milk of a group of farms were effectively reduced, however, by experimental introduction of a quality payment system with extra payments for milk with spore counts below 300/l. It appeared that this reduction was due entirely to greater care in washing udders for milking. ADL

### 34

Factors influencing radiation resistance of vegetative bacteria and spores associated with radappertization of meat.

Ma, K.; Maxcy, R. B.

*Journal of Food Science* 46 (2) 612–616 (1981) [26 ref. En] [Dep. of Food Sci. & Tech., Univ. of Nebraska, Lincoln, Nebraska 68583, USA]

Influence of some factors involved in radappertization of meats on the radiation resistance of 2 isolates of *Moraxella-Acinetobacter* (M-A), *Micrococcus radiodurans*, *Escherichia coli*, and *Bacillus cereus* spores was determined. Combination of subfreezing temp. and lyophilization increased the resistance of vegetative cells and showed M-A isolates to be most resistant. Cells lyophilized in ground beef were less resistant than cells lyophilized in a commercial culture medium. A preirradiation heat treatment prior to lyophilization sensitized the cells to radiation. No appreciable difference in resistance was found with the presence of up to 8% NaCl during irradiation of M-A and *M. radiodurans*. Radiation resistance of *B. cereus* spores was not affected by changes in temp., drying, or suspending medium to the same extent as were the vegetative cells. *B. cereus* spores were more resistant at ambient temp. than at  $-30 \pm 10^\circ\text{C}$ . All these factors must be considered in assessing the magnitude of radiation resistance of various organisms, because there is no predictable pattern of radiation resistance. IFT

### 35

[Examination of honeys for spores of *Clostridium botulinum*.] Untersuchungen von Bienenhonig auf *Clostridium botulinum*-Sporen.

Flemming, R.; Stojanowic, V.

*Archiv für Lebensmittelhygiene* 31 (5) 179–180 (1980) [13 ref. De, en] [Staatliches Veterinäruntersuchungsamt, Marburger Strasse 54, 6300 Giessen/Lahn, Federal Republic of Germany]

92 commercial samples of honey were examined for *Cl. botulinum* spores using the method of Sugiyama et al. [FSTA (1979) 11 5L342] which employs dialysis of the honey, enrichment of spores in TPGY medium (trypticase, peptone, glucose, yeast extract), and assay of botulinum toxins in animal experiments (mice). *Cl. botulinum* spores were not detected in any of the samples. AS



## 36

[The contamination of honey by spore-forming bacteria.]

Mitamura, H.; Kameyama, K.; Ando, Y.

*Report of the Hokkaido Institute of Public Health [Hokkaidoritsu Eisei Kenkyusho Ho]* No. 29, 16-19 (1979) [6 ref. Ja]

Aerobic and anaerobic sporulating bacteria, found in samples of 30 kinds of honey, were characterized and their reaction to heat shock (60°C for 30 min) was tested. Aerobic bacteria found were *Bacillus* spp., including *B. cereus*, *B. megaterium*, *B. circulans*, *B. coagulans* and *B. subtilis*. Anaerobes were *Clostridium tertium*, *Cl. perfringens*, *Cl. sordellii*, *Cl. butyricum* and *Cl. botulinum*. The degree of contamination was measured by the MPN technique. [From tables.] LH

## 37

Viable spores of the microorganism *Bacillus thuringiensis* Berliner; exemption from the requirement of a tolerance.

United States of America, Environmental Protection Agency

*Federal Register* 45 (166, Aug. 25) 56346-56347 (1980) [En] [Washington, DC, USA]

Residues of the microbial insecticide *Bacillus thuringiensis* Berliner are exempt from the requirement of a tolerance under the Federal Food, Drug, and Cosmetic Act in or on beeswax or honey. CAS

## 38

[Milk and milk products - determination of anaerobic sporeforming organisms in milk.]

Romania, Institutul Roman de Standardizare

*Romanian Standard STAS 6349/5-80*, 3pp. (1980) [Ro] Price L1.00 [Str. Roma 32-34, Bucharest, Romania]

The method is suitable for examination of milk for cheesemaking. 5 tubes each with 5 ml milk plus 2 ml paraffin wax are heated at 80°C for 10 min and subsequently incubated at 37°C for 48 h. Milk is classified as good if no tube shows gas production, satisfactory if 1 of 5 tubes shows gas, or unsatisfactory if 2 or more tubes show gas. JMD

## 39

[Effect of irradiation of bacterial spores on their heat resistance.]

Zsulc, M.; Stefaniakowa, A.; Peconek, J.; Stanczak, B.; Bielecka, J.

*Medycyna Weterynaryjna* 35 (12) 731-735 (1979) [16 ref. Pl, ru, en] [Katedra Higieny Produktow Zwierzecych, Wydzial Weterynaryjny, SGGW-AR, Warsaw, Poland]

In experiments analogous to those described in the preceding abstr., spores of named strains of (i) *Bacillus cereus*, (ii) *B. subtilis*, (iii) *Clostridium perfringens* type D, and (iv) *C. botulinum* type B were exposed to X-ray irradiation at 5, 10, 50 and 100 krad for (i) and (ii), 50, 100 and 200 krad for (iii), and 100, 200 and 300 krad for (iv) at 11 rad/s in saline or broth. Non-irradiated controls and the treated spores were heated for 15 min

at 80°, 90°, 75° and 75°C for (i)-(iv) resp. The spores were then cultured anaerobically at 37°C for 24 h for (i) and (ii) and for 72 h for (iii) and (iv). Survival data are tabulated in detail for all variants. The relative sensitivity to irradiation decreased in the order (i)-(iv). The main conclusions were the same as those presented in the preceding abstr., and the value of exposure of products to small doses of ionizing radiation before pasteurization is re-emphasized. SKK

## 40

[Effect of irradiation of bacteria on spore formation.]

Zsulc, M.; Tropilo, J.; Olszewski, G.

*Medycyna Weterynaryjna* 36 (2) 69-73 (1980) [3 ref. Pl, ru, en] [Katedra Higieny Produktow Zwierzecych, Wydzial Weterynaryjny SGGW-AR, Warsaw, Poland]

In continuation of the experiments described in the 2 preceding abstr. and using similar procedures, effects on survival were studied of exposure of named strains of (i) *Bacillus cereus*, (ii) *B. subtilis*, (iii) *Clostridium perfringens* type D, and (iv) *C. botulinum* type B (except for (ii), the same strains as used before) to 100, 1000, 5000 or 10 000 rad X-ray radiation at 11 rad/s in saline or broth. Non-irradiated control and irradiated microorganisms were then incubated at 30°C for ≤ 48 h for (i) and (ii) and at 37°C for ≤ 144 h for (iii) and (iv), and their sporulation was measured. The results are tabulated in detail for all variants. The relative sensitivity to irradiation decreased in the order (iv) < (ii) < (iii) < (i), and was in general lower than that of Enterobacteriaceae studied earlier. Sporulation was weakened by increasing doses of irradiation in (i) and (ii), but no clear effect was found with (iii) and (iv). Resistance to irradiation increased in (i)-(iv) in the presence of protein (meat broth medium) in comparison with the saline medium; and sporulation intensity increased in (i) and (ii). SKK

## 41

[Distribution of glucose isomerase in various kinds of sporeforming bacteria.]

Avakyan, Z. G.; Bagdasaryan, S. N.; Makrosyan, L. S.; Afrikyan, E. K.

*Biologicheskii Zhurnal Armenii* 33 (9) 919-922 (1979) [7 ref. Ru, am] [Inst. Mikrobiol. AN ArmSSR, USSR]

Characteristics of 320 strains of 18 spp. of the genus *Bacillus*, obtained after 48 h incubation, are tabulated.

Fermentation activity was dependent on intensity of spore formation. Cultures with complete spore formation possessed weak glucose isomerase activity, or none at all. STI

## 42

[Survey of media promoting the recovery of heat-damaged spores of *Clostridium botulinum* and *C. sporogenes*.]

Komaki, M.; Matsuda, N.; Matsunawa, K.

*Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi]* 21 (4) 252-259 (1980) [13 ref. Ja, en] [Canners Ass. of Japan, Res. Lab., 460 Karibacho, Hodogaya-ku, Yokohama, Japan]

Spore counting media were compared for effect on the recovery of non-heat-treated and heat-treated spores of *Clostridium botulinum* and *C. sporogenes*.



The spore count obtained with each of 8 kinds of media was compared with that recovered with pork pea infusion agar (PPI). No difference was observed among the media in the recovery count of non-heat-treated spores. With heat-treated spores, however, the spore count recovered with yeast extract agar was largest, and was comparable to that recovered with PPI. As regards reducing agent added to the recovery medium, no significant difference was observed between sodium thioglycollate and L-cysteine monohydrochloride. No inhibitory effect was observed when the reducing agent was added to the medium before autoclaving. AS

### 43

**Some observations on the germination, heat resistance and outgrowth of fast-germinating and slow-germinating spores of *Bacillus cereus* in pasteurized milk.**

Stadhouders, J.; Hup, G.; Langeveld, L. P. M. *Netherlands Milk and Dairy Journal* 34 (4) 215-228 (1980) [21 ref. En, nl] [Netherlands Inst. for Dairy Res. (NIZO), Ede, Netherlands]

Slow-germinating (S) strains of *B. cereus* required more intensive heat treatment than did fast-germinating (F) strains for complete germination. F spores appeared to be much less heat resistant than S spores, but had stronger curdling properties. Heating for 2 min at 85°C gave max. activation of S spores whilst allowing practically all F spores to germinate and survive. Both types of *B. cereus* reached higher numbers in milk heated for 10 s at 94°C than in HTST pasteurized milk; spores grown on nutrient agar were more heat resistant than those grown on milk agar. Once the S spores had germinated in HTST pasteurized milk, they developed rapidly, and after 24 h at 20°C had reached counts similar to those of F spores treated in the same way. Final count of *B. cereus* in milk was lower when grown under anaerobic rather than aerobic conditions. CDP

### 44

**[Antibiotic properties against *Clostridium botulinum* B of *Clostridium sporogenes* strains isolated from canned meat.]**

Mierzejewski, J.

*Medycyna Weterynaryjna* 35 (4) 220-222 (1979) [9 ref. Pl, ru, en] [ul. Krancowa 1/15, 24-100 Pulawy, Poland]

249 strains of *C. sporogenes* isolated from 500 blown meat cans that had been kept 1-4 yr without refrigeration (including 178 isolated from 287 cans of ground pork) were examined. 56 (22%) of the strains were found to produce bacteriocines against *C. botulinum* B 1162. Cultures of the 4 most active strains reached max. activity after incubation for 2-3 days. The strains exhibited antibiotic activity also against *C. perfringens* A and a museum strain of *C. sporogenes*, but to a lesser extent than against *C. botulinum*. SKK

### 45

**Survival of bacteria in "soul foods" at 10-centigrade.** Stewart, A. W.

*Journal of Food Protection* 44 (4) 271-274 (1981) [6 ref. En] [Dep. of Natural Sci., South Carolina State College, Orangeburg, S. Carolina 29117, USA]

The fate of naturally occurring and added bacterial pathogens was determined in "soul foods" [including collard greens, field peas, sweet potatoes, and processed and semi-processed pig offals e.g. chitterlings, fatback, ham knuckles, jaws, maws (stomach), neck bones, pig ears, pig feet, pig tails, liver puddings, sausage (loose or encased) and crackling] purchased at local supermarkets and farm families while the foods were stored under conditions simulating those used for retail distribution, home storage, and preparation before use. Viable count detn. for 10 samples after 5 days at 10°C showed considerable decreases in comparison to the inoculum size, indicating that growth was not promoted. *Escherichia coli* survived in all the food samples but the populations decreased by 1-9 log cycles/g food. *Salmonella typhimurium* survived in 59% of the food samples. Except for farm family collard greens and sausage (encased), *Staphylococcus aureus* remained viable in all of the foods tested and was the only survivor in cracklings (cooked) obtained from both sources. *Clostridium perfringens* was detected in farm family field peas and 23% of the pig offal samples. AS

### 46

**[Possibility of growth of *Clostridium botulinum* in tomato juice.]**

Gola, S.; Casolari, A.

*Industria Conserve* 55 (4) 294-298 (1980) [27 ref. It, en] [Sta. Sperimentale per l'Ind. delle Conserve Alimentari, Parma, Italy]

The possibility of growth of *Cl. botulinum* spores together with some microorganisms in tomato juice, pH 4-4.3 was investigated, using 3 strains of *Cl. botulinum*, 6 moulds, 6 enterobacteria, 2 bacilli and 1 *Pseudomonas*. The spores were found to grow and form toxins in the presence of 2 enterobacteria (*Serratia marcescens* and *Enterobacter aerogenes*) and 1 strain of *Aspergillus* (A.AL). In the presence of other bacteria (*Proteus* sp., *Citrobacter* sp., *Klebsiella* sp., *Escherichia coli*, *Pseudomonas* sp., *Bacillus licheniformis* and *B. polymixa*) and 5 other mould strains the spores did not grow. *Cl. botulinum* growth was correlated with the rise in pH brought about by the bacteria and apparently with the O<sub>2</sub> tension in the environment. The other 5 moulds appeared to inhibit growth of *Cl. botulinum* in spite of the rise in pH, presumably by the production of antibiotic metabolites. [From En summ.] RM

### 47

**The destruction of bacterial spores upon compressional pressure.**

Lee, C.-H.; Kim, Y. M.; Lee, J. C.; Jung, P. K. *Korean Journal of Food Science and Technology* 12 (4) 272-277 (1980) [10 ref. En, ko] [Dep. of Food Tech., Korea Univ., Seoul 132, S. Korea]

Spores of (i) *Bacillus coagulans*, (ii) *B. subtilis*, and (iii) *Clostridium butyricum* and vegetative cells of (iv) *Streptococcus faecalis* were mixed with filler (mixtures of lactose and corn starch) and made into tablets under



compressional pressures of 500–3500 kg/cm<sup>2</sup>. Viable cell counts were carried out. Major spore destruction occurred during tableting (60–70% destroyed). Decimal reduction pressure (P) was 2.9, 2.6, 2.1 and 1.7 t/cm<sup>2</sup> for (i)–(iv), resp., and varied according to the filler mixture used, i.e. for (i) P was 2.8 t/cm<sup>2</sup> in a 70% lactose/30% corn starch filler, and 2.0 t/cm<sup>2</sup> in a 60% corn starch/40% lactose filler. Number of viable spores was inversely proportional to the hardness and density of the tablet. LH

## 48

### Determination of antibiotics in meat using *Bacillus stearothermophilus* spores.

Bielecka, M.; Baldock, J. D.; Kotula, A. W.

*Journal of Food Protection* 44 (3) 194–200 (1981)

[35 ref. En][Meat Sci. Res. Lab., USDA, SEA, Beltsville, Maryland 20705, USA]

10 parameters affecting sensitivity, accuracy and simplicity of the diffusion plate method for determining antibiotic residues in meat were evaluated with spores of *Bacillus stearothermophilus* as the test organism.

8 antibiotics were studied: penicillin, bacitracin, tetracycline, chlortetracycline, oxytetracycline, streptomycin, erythromycin and neomycin. Sensitivity of the method was most influenced by concn. of inoculum, quantity of assay medium on the plate, and sample size. The optimal concn. of inoculum was established as  $2 \times 10^5$  spores/ml of medium, quantity of the assay medium on plate/100 mm diam. as 6 ml, and quantity of sample poured on disc/12.7 mm diam. as 100 µl. The pH of the assay medium was also important to both antibiotic potency and test organism growth. The activity of streptomycin and erythromycin was the most sensitive to pH variations. AS

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H. BROOKES

EDITOR





[Proteolysis of milk with microorganisms immobilized on agar gel: effect on some lactic acid cultures (*Lactobacillus bulgaricus*, *Streptococcus thermophilus*).]

Costamagna, L.

*Scienza e Tecnica Lattiero-Casearia* 32 (1) 41-49 (1981) [30 ref. It, en] [Istituto di Microbiol. Lattiero Casearia, Univ., Perugia, Italy]

Milk was given proteolytic treatment for 15 min at 60°C with *Bacillus subtilis* or *Pseudomonas* spp. cells immobilized on agar gel. Growth and acid production of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* strains, singly and especially in association, were much better in this milk than in untreated milk. Untreated milk, milk treated with *B. subtilis* and milk treated with *Pseudomonas* spp., resp., contained 0.41, 0.46 and 0.45 g total N/100 ml, with 0.304, 0.296 and 0.336 g casein N, 0.028, 0.054 and 0.0365 g non-protein N, and 0.027, 0.061 and 0.0355 g proteose-peptone N. Treatment with *Pseudomonas* spp. produced a much greater increase in free amino acids (especially leucine, lysine, isoleucine, valine and phenylalanine) than treatment with *B. subtilis*. ADL

## 2

[Enzymic proteolysis in UHT milk products.

I. Production of proteinases by bacteria during their growth in milk.]

Driessen, F. M.

*Zuivelzicht* 73 (31/32) 656-658 (1981) [5 ref. Nl, en] [Nederlands Inst. voor Zuivelonderzoek, Ede, Netherlands]

Milk was treated by a UHT process (5 min at 105°C), then inoculated with *Pseudomonas fluorescens* 22F (55 000/ml milk) and stored at 7°C. At intervals it was tested for proteolysis, using a specially developed method to estimate the % of para- $\kappa$ -casein compounds formed. Proteolysis was not observed until after 72 h, at the end of the growth phase of the bacteria, when the bacterial count was over 10 million/ml. Marked proteolysis was observed, however, after  $\geq 0.05\%$  of a *P. fluorescens* culture (500 000/ml), which had attained full growth at 20°C, was added to the milk. This suggested that contamination due to residues in tanks or defective cooling could render milk unsuitable for UHT products, even though its bacterial count might be low. In further experiments, milk which was kept for 5 days at 4-6°C before UHT treatment showed a marked increase in non-protein N (indicating proteolysis by bacterial enzymes) during subsequent storage at 20°C. By contrast there was only a slight increase in non-protein N (due probably to the natural alkaline milk proteinase) in milk which had been UHT-treated when fresh or after only 2 days' storage at 6°C. ADL

## 3

Unique response to heat of extracellular protease of *Pseudomonas fluorescens* M5.

Marshall, R. T.; Marstiller, J. K.

*Journal of Dairy Science* 64 (7) 1545-1550 (1981) [18 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Missouri, Columbia, Missouri 65211, USA]

## 4

Determination of L-cysteine with L-methionine  $\gamma$ -lyase.

Tanaka, H.; Imahara, H.; Esaki, N.; Soda, K.

*Agricultural and Biological Chemistry* 45 (4) 1021-1022 (1981) [8 ref. En] [Lab. of Biochem., Kyoto Coll. of Pharmacy, Yamashina, Kyoto 607, Japan]

An enzymic method for detn. of L-cysteine based on use of L-methionine  $\gamma$ -lyase (EC 4.4.1.11) from *Pseudomonas putida* [partially purified as described in *FEBS Letters* (1976) 66, 307] is described. The enzyme catalyses formation of  $H_2S$ ,  $NH_3$  and pyruvate from L-cysteine during incubation at 37°C in potassium phosphate buffer at pH 8.0 with pyridoxal phosphate. The reaction is stopped with trichloroacetic acid, and pyruvate is determined spectrophotometrically by reaction with 3-methyl-2-benzothiazolone and  $NH_3$  is determined by reaction with nitroprusside-hypochlorite. The assay is suitable for use in foods, but is subject to interference from L-methionine and other substrate compounds such as S-methyl-L-cysteine. DIH

## 5

[*Pseudomonas* and foods.]

D'Aubert, S.; Artavanis, S.; Gaetano, A. de; Cantoni, C. *Industria Alimentari* 20 (4) 271-275 (1981) [4 ref. It, en] [Istituto Ispezione degli Alimenti di Origine Animale, Univ. degli Studi, Milan, Italy]

The classification (tabulated) and behaviour of *Pseudomonas* spp., their multiplication in and effect on foods are reviewed. Strains from 146 samples of mussels, fresh- and sea-water fish, chicken, turkey, beef and egg yolk showed great diversity in *Pseudomonas* counts: (i) *P. fluorescens*, (ii) *P. putida* and (iii) *P. aeruginosa* most frequently found (% for (i) - (iii) resp. were: mussels, 35.5, 17.7 and 31.5; freshwater fish, 74.3, 6.2 and 19.5; seawater fish, 28.6, 64.5 and 6.9; turkey, 72.7, - and 27.3; chicken, 100, - and -; beef, 52.77, 15.3 and 27.43; and egg yolk, 15.5, 84.5 and -). The degradation of N compounds by *Pseudomonas* in various types of animal tissue was also considered. The effect on amino acids was common to all the pseudomonas, but *P. putrefaciens* was most directly responsible for sensory deterioration. KME

## 6

[Mass outbreak of food poisoning by goulash contaminated with *Pseudomonas aeruginosa*.]

Rokoszewska, J.; Smykal, B.; Bogdanowicz, E. *Roczniki Panstwowego Zakladu Higieny* 31 (3) 253-256 (1980) [10 ref. Pl, ru, en] [Wojewodzka Sta. Sanitarno-Epidemiologiczna, 65-470 Zielona Gowa, Poland]



53 (50 children and 3 adults) of 129 people using the canteen of a centre for deaf and hard-of-hearing children showed food poisoning symptoms 7–12 h after eating a supper of beef goulash. *Ps. aeruginosa* was detected in the goulash at a titre of 10 000/g in the absence of other pathogenic microorganisms, and was found in rectal smears of all those involved in the outbreak and also in rectal smears of kitchen personnel who showed no symptoms. The contamination is ascribed to dirty kitchen equipment; and its exacerbation through keeping the goulash warm, or at room temp. (with only 1 h at 6°C) for 7 h after its preparation for lunch is blamed for the outbreak. SKK

## 7

**Application of living immobilized cells to the acceleration of the continuous conversions of ethanol (wort) to acetic acid (vinegar) – hydrous titanium(IV) oxide-immobilized *Acetobacter* species.** Kennedy, J. F.; Humphreys, J. D.; Barker, S. A.; Greenshields, R. N.

*Enzyme and Microbial Technology* 2 (3) 209–216 (1980) [40 ref. En] [Res. Lab. for Chem. of Bioactive Carbohydrates & Proteins, Dep. of Chem., Univ. of Birmingham, PO Box 363, Birmingham B15 2TT UK]

Various strains of *Acetobacter* spp. have been immobilized on hydrous titanium(IV) oxide or hydrous titanium(IV) chelated cellulose and used in the continuous conversion of a dilute aqueous alcoholic solution (in the form of 'charging wort') into acetic acid (in the form of vinegar) in tower fermenter-type reactors. A strain of *Acetobacter* sp. producing extracellular polysaccharide aggregated in the presence of hydrous titanium(IV) oxide thereby enabling higher medium flow rates and an increased acetic acid output to be achieved. A strain of *Acetobacter* sp. not producing polysaccharide showed no effect with hydrous titanium(IV) oxide but did produce more acetic acid when a titanium(IV)-cellulose chelate was added to the fermentation, although aggregation was not observed. Mechanisms, which appear to conform to established results, are proposed for the aggregation of both strains of bacteria. Apparently, these water-insoluble titanium compounds can interact with the bacterial cells, increasing their density and thus making them more resistant to 'wash out' by increasing the rate at which they sediment in the fermenter. This enables a greater cell mass unit vol. to be achieved which in turn leads to an increase in conversion rate in the reactor. AS

## 8

**Factors influencing the activity of a heat-resistant lipase of *Pseudomonas*.**

Adams, D. M.; Brawley, T. G.

*Journal of Food Science* 46 (3) 677–680 (1981) [15 ref. En] [Campbell Inst. for Res. & Tech., Campbell Soup Co., Camden, New Jersey 08101, USA]

The heat resistant lipase of *Pseudomonas* spp. MC50 hydrolysed coconut oil, corn oil, butter oil and olive oil. Lipase activity was max. at 1% corn oil. The effects of pH and temp. on lipase activity varied with the substrate. The pH optima were in the range pH 8–9; the temp. optima were in the range 35°–40°C. Of several emulsifiers tested, 4 supported significant lipase activity, and 3 supported no lipase activity and may have inhibited the lipase. Emulsifier concn. influenced lipase activity. All stabilizers tested supported lipase activity; above 0.36% stabilizer concn. had no effect. IFT

## 9

**[Two different secondary structures of *Xanthomonas* polysaccharide.]** Zwei unterschiedliche Sekundärstrukturen bei *Xanthomonas*-Polysaccharid. Seeger, B.

*Nahrung* 25 (7) 655–666 (1981) [14 ref. De, en, ru] [VEB Gärungschemie Dessau, German Democratic Republic]

Observed quality differences between low pyruvate and high pyruvate xanthan are explained by the existence of single helices (single molecules), in addition to double helices comprising several xanthan molecules. Occurrence during fermentation of the 2 structures as a function of pyruvate content of the xanthan molecules and on the electrolyte content of the fermentation solution is discussed. The improved quality of heated xanthan solutions is explained by incorporation of single helices into newly formed double helices. IN

## 10

**Factors influencing the heat resistance of a heat-resistant lipase of *Pseudomonas*.**

Adams, D. M.; Brawley, T. G.

*Journal of Food Science* 46 (3) 673–676 (1981) [16 ref. En] [Campbell Inst. for Res. & Tech., Campbell Soup Co., Camden, New Jersey 08101, USA]

*Pseudomonas* spp. MC50 produced an extra-cellular lipase that was extremely heat resistant at 100–150°C when heated in water or emulsions. The D-values ranged from 40 min at 100°C to 84 s at 150°C. The z<sub>D</sub>-value was 36°C. When heated in water, the lipase

exhibited greatest survival at pH 8.5. Below pH 6.5, survival was < 10% of that at pH 8.5. Survival of lipase heated in emulsions was affected somewhat by the type of oil (butter, coconut, olive, corn), corn oil concn. and type of emulsifier. Type of stabilizer or stabilizer concn. had little effect on lipase survival. Lipase treated with ethylenediaminetetraacetate was fully heat resistant in water; survival declined when lipase was heated in CaCl<sub>2</sub> solutions of 3–120 mM. IFT

## 11

**Effects of acids on potassium sorbate inhibition of food-related microorganisms in culture media.**

Restaino, L.; Komatsu, K. K.; Syracuse, M. J.

*Journal of Food Science* 47 (1) 134–138, 143 (1982) [En] [Armour Res. Cent., 15101 N. Scottsdale Road, Scottsdale, Arizona 85260, USA]

Effects of potassium sorbate in combination with citric, lactic, phosphoric, and hydrochloric acids on the growth of 6 food-related microorganisms were studied. Trypticase soy broth with 0.1 or 0.2% sorbate adjusted to pH 5.5 with any of the acids was bacteriostatic to *Yersinia enterocolitica* 0:17. These combinations at pH 5.5 were also bacteriostatic to *Salmonella* group D, and extended the lag phase of *Pseudomonas fluorescens* for 24 h. Combinations of either organic acid with 0.2% sorbate at pH 5.5, reduced the growth rate of *Lactobacillus plantarum* and an unidentified *Lactobacillus* isolated from frankfurters. *Pseudomonas aeruginosa* was unaffected by any sorbate-acid combination. Organic acids, specifically citric and lactic, potentiate the antimicrobial action of potassium sorbate. IFT



12

### Growth and associated enzymic activity of spoilage bacteria in pasteurized double cream.

Phillips, J. D.; Griffiths, M. W.; Muir, D. D.  
*Journal of the Society of Dairy Technology* 34 (3) 113-118 (1981) [46 ref. En] [Hannah Res. Inst., Ayr KA6 5HL, UK]

A total of 35 batches of pasteurized double cream from the 3 creameries (A, B and C) participating in the survey [see preceding abstr.] were examined after storage at 6° and 10°C for 13 days or when organoleptically unacceptable. *Pseudomonas* spp. were the predominant spoilage organisms at all creameries, but creams from B contained less *Bacillus* spp. than creams from A or C; it is suggested that spoilage in creams from B was due entirely to post-pasteurization contamination. Creams contained considerably more *Bacillus* spp. after storage at 10°C than at 6°C, the lag phase being markedly reduced at the higher temp. *Bacillus* spp. tended to be present in pasteurized cream in greatest numbers during summer and autumn, but no such seasonal variation was seen in either spore or thermotolerant count of the standardized cream prior to heat treatment. 54.6% of *Bacillus* isolates were

*B. cereus* and 20.7% were *B. cereus* subsp. *mycoides*. 63% of isolates showed enzymic action on milk protein and/or fat and 46% showed phospholipase activity. CDP

13

### [Evaluation of selective media for determination of *Pseudomonas* spp. counts in fish.]

Leitao, M. F. de F.; Delazari, I.; Geraldini, A. M.; Santos, C. A.; Shirole, L.  
*Coletanea do Instituto de Tecnologia de Alimentos* 11, 1-13 (1980) [23 ref. Pt, en] [Inst. de Tech. de Alimentos, Campinas, Sao Paulo, Brazil]

Comparative studies were conducted on 3 selective media for isolation of *Pseudomonas* spp. from fish: (i) Merck GSP agar; (ii) Grant & Holt medium [Applied & Environmental Microbiology (1977) 33, 1222-1224]; and (iii) Naylor medium [personal communication] (a medium based on Difco plate count agar with addition of 0.5% peptone + 0.5% NaCl, plus triphenyltetrazolium chloride, pH 5.5). TSA agar was used as a control. Trials were conducted using cultures of *Pseudomonas fluorescens* (ITAL 005), *Ps. aeruginosa* (ITAL 006) and 2 *Pseudomonas* spp. isolated from fish. Trials conducted to test for inhibitory effects of the media on *Pseudomonas* spp. showed recovery (as % of that on TSA agar) to be 97.3 for (i), 98.5 for (ii) and 96.2 for (iii). Studies on selectivity (% of isolates from fish giving a positive result, and subsequently confirmed to be *Pseudomonas* sp.) showed the selectivity index to be (i) 90.6%, (ii) 93.3% and (iii) 85.3%. Differences between results with the 3 media were small, and generally not statistically significant. It is concluded that all 3 are suitable for use for testing for *Pseudomonas* spp. in fishery products. AJDW

14

### Solubility of muscle proteins as a result of autolysis and microbiological growth.

Chen, M. T.; Ockerman, H. W.; Cahill, V. R.; Plimpton, R. F., Jr.; Parrett, N. A.  
*Journal of Food Science* 46 (4) 1139-1143, 1158 (1981) [46 ref. En] [Dep. of Anim. Sci., Ohio State Univ., Columbus, Ohio 43210, USA]

Bovine *longissimus dorsi* samples, collected aseptically 3 h postmortem, were used to determine natural muscle enzyme activity. Samples of this tissue were inoculated with *Pseudomonas putrefaciens* or *Lactobacillus casei* and incubated 0, 1, 7, 14, and 21 days at 2°C and 0, 1, and 3 days at 25° and 37°C. Protein solubility, pH and microbial counts were determined after appropriate periods of storage. Only small differences were noted in the solubility of muscle proteins between the muscle treatments after 21 days of storage at 2°C, compared to much larger differences noted after only 3 days of storage at higher incubation temp. (25° and 37°C). IFT

15

### Bacterial flora of ground beef and soy extended ground beef during storage.

Harrison, M. A.; Melton, C. C.; Draughon, F. A.  
*Journal of Food Science* 46 (4) 1088-1090 (1981) [17 ref. En] [Dep. of Food Tech. & Sci., Univ. of Tennessee, Knoxville, Tennessee 37901, USA]

(i) Ground beef and (ii) ground beef extended with 20% textured soy protein (TSP) were examined to determine the predominant bacterial flora present during storage at 4°C for 6 days. Bacterial numbers in (ii) increased with time and at a faster rate than in (i). Spoilage odours were also detected earlier in (ii). For both (i) and (ii) *Pseudomonas* sp. were the predominant bacteria of fresh and stored samples. By the sixth day of storage at 4°C, the only psychrotrophs recovered were sp. of *Pseudomonas*. Considering these similarities, it appears that differences in the spoilage rate of (i) and (ii) cannot be attributed to differences in the composition of their respective bacterial flora. IFT

16

### Heat resistant bacterial lipases and ultra-high temperature sterilization of dairy products.

Adams, D. M.; Brawley, T. G.  
*Journal of Dairy Science* 64 (10) 1951-1957 (1981) [15 ref. En] [Dep. of Food Sci., N. Carolina State Univ., Raleigh, N. Carolina 27650, USA]

Properties of a heat-resistant lipase produced by *Pseudomonas* sp. MC50 (a psychrotroph isolated from raw milk) were studied. The lipase was resistant to heating in milk at 100-150°C and would be expected to survive UHT treatment at 121-149°C for 0.5-8 s. Optimum temp. and pH for lipase MC50 activity in butter oil emulsion were 40°C and 8.5, resp.; max. lipase activity was obtained with 5% butter oil emulsions. 5 samples of whole milk and 4 of 10% half-and-half were UHT sterilized at 137.8°C for 20.7 s, at 143.3°C for 7 s or at 148.9°C for 3.4 s, packaged aseptically and stored at room temp. or 40°C for up to 36 wk. All samples contained lipase activity that survived UHT treatment. Mean activity at 40°C was 1.9 × greater than at room temp. (25°C). These results indicate that heat-resistant bacterial lipases may cause rancidity in UHT milk products during storage. MEG



## 17

### The effect of carbon monoxide on bacterial growth.

Gee, D. L.; Brown, W. D.

*Meat Science* 5 (3) 215-222 (1981) [13 ref. En] [Dep. of Food Sci. & Tech., Inst. of Marine Resources, Univ. of California, Davis, California, 95616, USA]

Studies were conducted on growth of *Pseudomonas aeruginosa*, *Ps. fluorescens*, *Escherichia coli* and *Achromobacter* sp., in pure cultures, at 20°C in a glucose minimal medium, under atm with 0, 5, 10, 15, 20, 25, or 30% CO. Graphs of results are given. CO had no effect on growth of *Ps. aeruginosa*. It inhibited growth rate and increased lag phase in *Ps. fluorescens*, inhibited growth of *E. coli* and increased the lag phase in *Achromobacter* sp. The extent of these effects generally increased with increasing CO concn. Possible selective effects of CO-containing atm on the microflora are considered. The results are discussed in relation to use of CO in packaging atm for meat, etc. AJDW

## 18

### [The genus *Aeromonas* in mussels.]

Bersani, C.; D'Aubert, S.; Cantoni, C.

*Annali di Microbiologia ed Enzimologia* 30, 89-96 (1980) [39 ref. It, en] [Istituto di Ispezione degli Alimenti di Origine Anim., Univ. di Milano, Milan, Italy]

Studies on occurrence of *Aeromonas* spp. in mussels, and possible enteropathogenicity of *Aeromonas* spp., are described. A total of 60 isolates was studied. Most were identified (by morphological, biochemical and physiological criteria) as *A. hydrophila*; the remaining strains differed from typical descriptions of *Aeromonas* spp. Endoperitoneal injection of 0.5 ml of a culture of *A. hydrophila* into mice was commonly lethal; the other strains showed much lower lethality. AJDW

## 19

### Some biochemical changes in sarcoplasmic depleted, intact beef muscle inoculated with *Pseudomonas fragi*.

Yada, R. Y.; Skura, B. J.

*Journal of Food Science* 46 (6) 1766-1773, 1776 (1981) [En] [Dep. of Food Sci., Univ. of British Columbia, Vancouver, British Columbia, Canada]

24 h postmortem intact bovine *longissimus dorsi* muscle strips were washed to remove sarcoplasmic fluid, or left intact, and were either uninoculated or inoculated with *P. fragi* ATCC 4973 to evaluate the effect of decreased concn. of sarcoplasm on bacterial growth and subsequent spoilage during storage at 4°C for 12 days. Washing removed the majority of the water-soluble components of the muscle. Significantly ( $P < 0.01$ ) higher growth rates were observed on intact muscle than on washed muscle. Increased extractability of watersoluble and salt-soluble proteins was observed in intact inoculated muscle as growth of *P. fragi* progressed. Alterations in sodium dodecyl sulphate (SDS) gel electrophoretic patterns of water-soluble, salt-soluble, urea-soluble and urea-insoluble proteins were evident in the intact, inoculated muscle. Relatively little change in nonprotein N, water-soluble and salt-soluble protein content occurred in washed inoculated muscle with increased bacterial growth. Only minor changes in the SDS-gel electrophoretograms of the salt-soluble proteins from the washed, inoculated tissue were apparent. IFT

## 20

### Microbiology of meats in a hypobaric environment.

Restaino, L.; Hill, W. M.

*Journal of Food Protection* 44 (7) 535-538 (1981) [9 ref. En] [Armour Res. Cent., 15101, N. Scottsdale Road, Scottsdale, Arizona 85260, USA]

Total bacteria on surfaces of broiler chickens, pork loins and processed hams were determined during storage in a Grumman hypobaric trailer that maintained an environment of 28-31.5°F, 85-95% RH and a pressure of 5-20 mm Hg. For broiler chickens there was a lag period of 18 days before bacterial proliferation, vs. 7 days for conventional ice-pack boxes. Time required to reach levels of  $10^6$  bacteria/in<sup>2</sup> was 26 days for hypobaric storage vs. 18 days in ice-pack. Proliferation of bacteria in pork loins was studied by fabricating pork chops from loins held in hypobaric or conventional cold (32-33°F) storage for up to 25 days. For chops to have initial surface counts  $< 10^5$ /in<sup>2</sup>, loins could be held in hypobaric storage for up to 16 days, or for up to 1 wk in cold storage. Bone-in processed hams showed substantially reduced rate of bacterial growth in hypobaric storage. Predominant microorganism isolated from hams was *Streptococcus* sp.; *Pseudomonas* spp. predominated on fresh meats in hypobaric storage. DIH

## 21

### Production of off odours by isolates from poultry skin with particular reference to volatile sulphides.

Thomas, C. J.; McMeekin, T. A.

*Journal of Applied Bacteriology* 51 (3) 529-534 (1981) [18 ref. En] [Dep. of Agric. Sci., Univ. of Tasmania, GPO Box 252C, Hobart, Tasmania 7001, Australia]

Studies were conducted on off-odour production by psychrotrophic *Pseudomonas* strains isolated from broiler skin. *Pseudomonas* strains were cultured on sterile leg muscle and broiler skin preparations; production of S-containing volatiles on peptone broth (supplemented with methionine and cystine) and on muscle or skin as also studied. *Pseudomonas* groups I and II were the main off-odour producers. Overall, 40% of isolates produced organoleptically-detectable off-odours. Strains producing off-odours on muscle also produced them on skin. 60% of *Pseudomonas* group I strains produced off-odours, vs. 38% of group II strains. Sulphide-type odours predominated, being produced by group I and group III/IV strains; group II strains mainly produced fruity odours, although 30% also gave a sulphide-type taint. Culture in broths supplemented with methionine or cystine increased the proportion of samples producing sulphide off-odours. Methanethiol was the main off-odour produced; H<sub>2</sub>S is produced only by a minority of strains. AJDW

## 22

### Effect of the irradiation of bacteria upon their survival rate during conventional methods of meat preservation.

(In 'Combination processes in food irradiation' [see FSTA (1982) 14 8C331].) [Lecture]

Szczawinska, M.  
pp. 401-411 (1981) [16 ref. En] [Fac. of Vet. Sci., Agric. Univ. of Warsaw, Warsaw, Poland]

The effect of irradiation upon the survival rate of non-sporing bacteria (*Staphylococcus aureus*, *Salmonella typhimurium*, *Escherichia coli*,



*Pseudomonas fluorescens*) during basic methods of meat preservation was studied. The bacteria were irradiated in broth by X-rays at a dose that destroyed about 90% of the bacteria ( $D_{10}$ ). The survival rate of unirradiated and irradiated bacteria during cooling and freezing, in solutions of NaCl, nitrates and liquid smoke, was defined. The number of microorganisms was determined directly after irradiation as well as 1, 3, 7, 14, 21 and 28 days after irradiation. The effect of irradiation upon heat resistance of the examined sp. of bacteria was also defined. The microorganisms were heated in broth, at 70°C for 1, 2 and 5 min. The obtained results were subjected to statistical analysis. On the basis of the research results, a faster dying rate of irradiated populations of *S. aureus* and *E. coli* during any type of preservation treatment, the lack of any reaction to irradiation regarding the survival rate of *S. typhimurium*, and the lack of any effect of irradiation upon the rate of deterioration of *P. fluorescens* during freezing and storage in a solution with 10% addition of NaCl, were observed. A pronounced effect of irradiation upon the lowering of the heat resistance of the bacteria, as well as delayed growth in other variants of the experiment, was determined. AS

## 23

[Effect of yellow pigmented bacteria on malt quality.] Pekhtereva, N. T.; Il'ina, A. I.; Bogdanova, L. V. *Fermentnaya i Spirtovaya Promyshlennost'* No. 7, 10-11 (1981) [3 ref. Ru] [Kemerovskii Tekh. Inst. Pishchevoi Promyshlennosti, Kemerovo, USSR]

The effect of yellow pigmented bacteria *Pseudomonas herbicola* on the germination capacity of grain, and quality of malt produced from barley with various protein contents was studied. Treatment of grain by means of pure culture of bacteria resulted in higher germination capacity. The most favourable counts of bacteria to improve the germination capacity of barley were found to be 5-7 million cells/ml water. The energy and germination capacity of barley were increased by 6.0-9.0%. Treatment of barley grain in the course of steeping by means of yellow pigmented bacteria resulted in better quality of malt and reduction of the germination period by 1 day. STI

## 24

Isolation of pectinolytic *Aeromonas hydrophila* and *Yersinia enterocolitica* from vacuum-packaged pork. Myers, B. R.; Marshall, R. T.; Edmondson, J. E.; Stringer, W. C. *Journal of Food Protection* 45 (1) 33-37 (1982) [53 ref. En] [Dep. of Food Sci. & Nutr., Univ. of Missouri, Columbia, Missouri 65211, USA]

A survey was made of commercially available vacuum-packaged fresh pork held at 5°C for 7, 14, 21 and 28 days. Also, 4 vacuum-packaged leg roasts were stored for 21 days at 5°C then for 90 days at -18°C before sampling. Surface cores of meat were enriched in sorbitol bile broth 21 days at 5°C to enhance recovery of *Yersinia enterocolitica* on pectin agar. Of the 54 samples surveyed, 20% yielded highly pectinolytic colonies of *Aeromonas hydrophila* that were cytotoxic

to Y1 and HeLa cells, 6% yielded *Y. enterocolitica* and 6% yielded *Yersinia intermedia*. *Yersinia* was recovered from both fresh and frozen samples. This is believed to be the first report of pectinolysis by *A. hydrophila* and recovery of cytotoxic *A. hydrophila* from vacuum-packaged pork. AS

## 25

Radurization of poultry meat. [Lecture]

Piszer, W.; Zabielski, J.; Mroz, J.

*Proceedings of the European Meeting of Meat Research Workers* No. 26, Vol. I, E-22, pp. 248-251 (1980) [16 ref. En] [Acad. of Agric., Poznan, Poland]

Broilers (carcass wt. 0.9-1.2 kg), including pale soft exudative, normal and dark firm dry samples, were vacuum-packaged and irradiated at 2.5 and 5.0 kGy. Changes in sensory characteristics, microbiological properties and fat characteristics (TBA value, peroxide value, free fatty acid concn.) during storage for up to 28 days at 4°C were determined. Little effect of irradiation on fat quality indices was observed. Differences in sensory properties of the irradiated carcasses were of only moderate practical significance; Vienna sausages made from irradiated broiler meat were, however, of poor sensory quality. Total plate count of chicken decreased considerably as a result of irradiation, then increased gradually during storage. Radiation resistance of *Pseudomonas* and *Bacillus* isolates is considered. [See FSTA (1982) 14 8S1379.] AJDW

## 26

Growth kinetics of *Xanthomonas campestris* B-1459. Patton, J. T.; Dugar, S. K.

*Process Biochemistry* 16 (5) 46-49 (1981) [6 ref. En] [Dep. of Chem. Eng., New Mexico State Univ., New Mexico, USA]

A method for adapting the synthesis of xanthan, a biopolysaccharide produced by bacteria of the genus *Xanthomonas*, and used as a viscosifier in food, to continuous fermentation is described. The technique of increasing the dilution rate to wash out the xanthan formed so as to maintain a low viscosity medium that accelerates growth was used to study the kinetics of growth in continuous fermentation. Under these conditions the organism exhibited a doubling time of 2.5 h, reasonable in comparison with other aerobic organisms, and 10× higher than the growth rate in batch fermentation. SP

## 27

A selective medium for the isolation and differentiation of *Gluconobacter* and *Acetobacter*. Cirigliano, M. C.

*Journal of Food Science* 47 (3) 1038-1039 (1982) [En] [Microbiol. Services Dep., T. J. Lipton Inc., 800 Sylvan Avenue, Englewood Cliffs, New Jersey 07632, USA]

A new medium permits selective isolation of acetic acid bacteria within 3 days and differentiation between *Gluconobacter* and *Acetobacter* within 48 h. Dextrose Sorbitol Mannitol (DSM) Agar was devised to provide differentiation of *Gluconobacter* and *Acetobacter*



based on the preferential oxidation of C sources. Selectivity is achieved by acidification and incorporation of cycloheximide to inhibit yeast and mould growth. To minimize interference by other acid-tolerant Gram-positive bacteria, best results were obtained with addition of 29.5 µg brilliant green or 0.1 g sodium desoxycholate/l medium. DSM has been used on a laboratory scale as both a selective and differential medium in beverage and fermentation quality control procedures. IFT

## 28

**The purification and characterization of a heat-stable protease from *Pseudomonas fluorescens* B52.** Richardson, B. C.

*New Zealand Journal of Dairy Science and Technology* 16 (3) 195-207 (1981) [26 ref. En] [New Zealand Dairy Res. Inst., Palmerston North, New Zealand]

## 29

**Evaluation of lactic acid bacteria for extending the shelf life of shrimp.**

Moon, N. J.; Beuchat, L. R.; Kinkaid, D. T.; Hays, E. R. *Journal of Food Science* 47 (3) 897-900 (1982) [En] [Dep. of Food Sci., Univ. of Georgia Agric. Exp. Sta., Experiment, Georgia 30212, USA]

44 strains of lactic acid bacteria (LAB) were tested for inhibitory activity against 3 strains of *Pseudomonas*, *Vibrio parahaemolyticus* and naturally occurring microflora on fresh deheaded shrimp. Cell-free filtrates and cell suspensions of 6 strains of LAB were inhibitory to growth of *Pseudomonas* on agar lawns. Degree of inhibition depended upon medium used for cultivation of LAB prior to testing, and presence or absence of LAB cells on the test lawns. Filtrates were generally more inhibitory than cell suspensions. Certain strains of *Streptococcus lactis* and *Lactobacillus casei* inhibited rate of growth of *Pseudomonas* in broth culture. Neither LAB retarded development of microflora of iced shrimp stored at 5° and 12°C. *L. casei* may have had an inhibitory effect on rate of growth of

*V. parahaemolyticus* on iced shrimp. Overall, data indicate that treatment of fresh shrimp with LAB to extend shelf life during storage on ice may not be practical. IFT

## 30

**Scanning electron microscope study of *Pseudomonas fragi* on intact and sarcoplasm-depleted bovine *longissimus dorsi* muscle.**

Yada, R. Y.; Skura, B. J.

*Applied and Environmental Microbiology* 43 (4) 905-915 (1982) [31 ref. En] [Dep. of Food Sci., Univ. of British Columbia, Vancouver, British Columbia V6T 2A2, Canada]

Intact bovine *longissimus dorsi* muscle strips used 24 h postmortem were washed to remove sarcoplasmic fluid or left intact and were either left uninoculated or inoculated with *P. fragi* ATCC 4973. The effects of decreased sarcoplasm concn. on growth of *P. fragi* and consequent microstructural changes of beef muscle during aerobic storage at 4°C for 12 days were evaluated. *P. fragi* grew slower on washed muscle than on intact muscle. Scanning electron micrographs revealed surface degradation of both intact inoculated and washed inoculated muscle only in areas of localized colonization. Extracellular fibrils appeared to mediate adhesion of *P. fragi* to the muscle surface as well as cell-to-cell attachment within microcolonies. *P. fragi* was also observed growing between muscle fibres. AS

## 31

**Loss of acetic acid resistance and ethanol oxidizing ability in *Acetobacter* strain.**

Ohmori, S.; Uozumi, T.; Beppu, T.

*Agricultural and Biological Chemistry* 46 (2) 381-389 (1982) [17 ref. En] [Dep. Agric. Chem., Univ. of Tokyo, Bunkyo-ku, Tokyo 113, Japan]

A thermophilic strain of *Acetobacter aceti*, No. 1023, was isolated that had full activity for vinegar production in submerged culture at 35°C. Growth of this strain in liquid YPGE medium containing ethanol led to high frequency of occurrence of mutants that had lost ethanol oxidizing ability and lost resistance to acetic acid. The high frequency of occurrence of mutants, the low frequency of revertants (< 1 in 10<sup>6</sup>), and the instability of ethanol oxidizing ability and acetic acid resistance compared with other genetic markers suggested that these properties were conferred by a plasmid. A plasmid was detected in strain 1023, but 1 of similar mol. wt. was also detected in the mutant strains. DIH

## 32

**[Nutrient requirements for the production of white vinegar.]**

Levonen, E.; Suarez, M. A.

*Revista de Agroquímica y Tecnología de Alimentos* 21 (2) 259-266 (1981) [11 ref. Es, en] [Inst. de Fermentaciones Ind., Juan de la Cierva, 3 Madrid 6, Spain]

Nutrient requirements for vinegar production by submerged fermentation with ethanol as substrate were studied in laboratory and industrial (Acetator Frings) fermentors. The composition of the nutrient media for *Acetobacter aceti* subsp. *aceti* in both types of fermenters is shown in tables. RM

## 33

**Influence of milk aeration on growth of psychrotrophic pseudomonads.**

Brandt, M. J.; Ledford, R. A.

*Journal of Food Protection* 45 (2) 132-134 (1982) [12 ref. En] [Dep. of Food Sci., Cornell Univ., Ithaca, New York 14853, USA]

The psychrotrophic microflora of raw milk from a Cornell University herd was examined and the 3 most frequently occurring isolates (*Pseudomonas fluorescens*,



*P. putida* and *P. aeruginosa*) were subjected to O<sub>2</sub> concn. of 1–12 p.p.m. and temp. of 3–9°C in growth studies in raw milk. At 3°C, a reduction in O<sub>2</sub> level from 9–12 to 1–3 p.p.m. resulted in a 63% increase in generation time for *P. fluorescens*. However, a reduction in growth temp. from 9 to 3°C at 9–12 p.p.m. O<sub>2</sub> produced a 280% generation time increase for *P. fluorescens*. Similar observations were made for the other isolates. Analysis of variance revealed a significant interaction between the effects of O<sub>2</sub> and temp. on growth of the isolates. It is concluded that increased attention should be given to sources of aeration in milk handling systems (e.g. leaky gaskets and improper operation of pumps). AS

### 34

#### **Destruction of microorganisms during thawing of skim milk.**

Gebre-Egziabher, A.; Thomson, B.; Blankenagel, G. *Journal of Food Protection* 45 (2) 125–126 (1982) [5 ref. En] [Dep. of Dairy & Food Sci., Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W0]

Viability of 4 spp. of microorganisms (*Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Saccharomyces cerevisiae*) during rapid and slow thawing of frozen milk was investigated. Results indicated that the destruction of microbial cells was significantly greater when skim milk was thawed slowly. Recovery of viable organisms by plating was generally slightly higher when peptone water was used as a diluent, although differences were not statistically significant. AS

### 35

#### **[Red-brown discoloration on the surface of Mozzarella cheese: the microorganisms responsible and method of prevention.]**

Giussani, G.; Carini, S. *Latte* 5 (10) 667–669 (1980) [6 ref. It, en] [Istituto di Ind. Agrarie, Univ. degli Studi, Milan, Italy]

A reddish-brown discoloration appeared on the surface of Mozzarella cheese made at a factory in Lombardy. The discolored areas had a heterogeneous microflora which consistently included mobile bacterial rods. Samples of the affected cheeses cultured on nutrient agar and reconstituted skim milk agar media also showed a reddish-brown discoloration. A bacterial strain was isolated and purified from these cultures and was identified as having the morphological, cultural and biochemical characteristics of *Pseudomonas synxantha*. Further incubation studies on Mozzarella cheese inoculated with the isolated bacteria indicated that the areas of intense discoloration were mainly confined to the parts of the cheese not immersed in the cheese fluid. When the liquid was in contact with the discolored areas it became an intense violet colour. Milk inoculated with the isolated bacteria also developed a violet colour. MC

### 36

#### **[*Pseudomonas* spp. and fish deterioration.]**

Gennari, M.; Cantoni, C.; Colombo, A. *Industria Alimentari* 20 (10) 685–690 (1981) [18 ref. It] [Istituto di Ispezione degli Alimenti di Origine Anim., Milan, Italy]

A study of the role of *Pseudomonas* spp. in the deterioration of fish is reported. While other organisms decrease, the pseudomonads multiply rapidly, utilizing the non-protein N compounds of muscular fluids for growth, even at low temp. Recent research has identified *P. fluorescens*, *P. perolens*, *P. putida*, *P. putrefaciens*, and especially the *Alteromonas* group as chiefly responsible for the deteriorative changes in fish, especially in odour. 12 samples of tuna dorsal muscles and adjacent tissues were analysed 0–12 days after catching for pH, Eh, and concn. of volatile basic N. The deleterious effect of the isolated *Pseudomonas* strains was also determined by measuring free NH<sub>3</sub> and the activity of the bacteria in degrading soluble proteins (dialysis and electrophoresis). Results (given tabularly and diagrammatically) suggested that the major sources of contamination were the gills and intestines of the fish; that the most active bacterium was *P. fluorescens*; and that there were high correlation coeff. between total NH<sub>3</sub> produced and rate of bacterial growth ( $r = 0.84$ ) and between total NH<sub>3</sub> and corresponding free NH<sub>3</sub> ( $r = 0.82$ ). KME

### 37

#### **Numerical taxonomic study of *Pseudomonas* strains from spoiled meat.**

Shaw, B. G.; Latty, J. B. *Journal of Applied Bacteriology* 52 (2) 219–228 (1982) [30 ref. En] [Meat Res. Inst., Langford, Bristol BS18 7DY, UK]

A numerical taxonomic study using 160 unit character was performed on 110 isolates of pseudomonads from aerobically spoiled beef and pork and on 13 named strains from the genus *Pseudomonas*. 4 clusters of meat strains were detected at 87% S. Non-fluorescent strains were contained in 2 closely related clusters (1 and 2) which were identified with *P. fragi*. Clusters 3 and 4 contained fluorescent strains which were distinct from *P. fluorescens*, *P. putida* and the other named strains examined. An identification scheme based on 11 C source tests is presented for the recognition of cluster members. AS

### 38

#### **[Effect of sublethal heating on proteolytic properties of *Pseudomonas aeruginosa*.]**

Uradzinski, J. *Medycyna Weterynaryjna* 36 (11) 676–678 (1980) [6 ref. Pl, ru, en] [Katedra Higieny Produktow Zwierzeczych, Wydział Weterynaryjny, AR-T, Olsztyn, Poland]

A collection strain of *Ps. aeruginosa* was heated in nutrient broth for 15 min at 44°, 56°, 68°, 80° or 84°C, and survival and gelatin proteolysis activity of the control and heated cultures were studied. Survival diminished progressively with increase in heating temp above 44°C, and thermal death occurred at 84°C. Intensity of gelatin proteolysis decreased at the 1st 4 temp. by 10.4, 29.0, 40.0 and 53.3% resp. SKK

**[Effect of irradiation on proteolytic properties of bacteria.]**

Szulc, M.; Stefaniakowa, A.; Stanczak, B.; Peconek, J.  
*Medycyna Weterynaryjna* 36 (9) 540-543 (1980) [7 ref.  
 Pl, ru, en] [Katedra Higieny Produktów Zwierzęcych,  
 Wydział Weterynaryjny, SGGW-AR, 02-528, Warsaw,  
 Poland]

After preliminary tests had established suitable radiation doses, 24 cultures of collection strains of (i) *Proteus vulgaris*, (ii) *Pseudomonas aeruginosa* and (iii) *Ps. fluorescens*, and suspensions of (iv) *Bacillus subtilis* spores were exposed in buffered physiological saline or in broth to X-ray radiation at 11 rad/s and for (i) and (ii) 100, 1000, 5000 and 10 000 rad, for (iii) 100, 1000 and 5000 rad, and for (iv) 5000, 10 000, 50 000 and 100 000 rad. Data on survival and proteolytic activity (size of clear zones round colonies on plates) are tabulated in detail for all variants. (ii) showed the least survival and (iv) showed the greatest; mortality of (i)-(iii) was greater at a given radiation dose than loss of proteolytic activity; no loss of proteolytic activity was shown by vegetative forms of (iv) in the dose range used; presence of protein in the medium had no substantial effect on proteolytic activity of daughter cells of (i)-(iv). [See also following abstr.] SKK

**Microbial evaluation of radurized pomfret (*Stromateus cinereus*).**

Sherekar, S. V.; Gore, M. S.

*Fleischwirtschaft* 62 (5) 615-617 & 651-653 (1982)  
 [26 ref. En & De] [Biochem. & Food Tech. Div., Bhabha  
 Atomic Res. Cent., Trombay, Bombay 400 085, India]

Changes in the microbial population and its biochemical characteristics in unirradiated and  $\gamma$ -irradiated (100 Krad) pomfret were investigated. While *Pseudomonas* formed the predominant (48%) flora of unirradiated pomfret, 58% of the isolates in irradiated pomfret belonged to *Achromobacter* spp. Incidence of *Staphylococcus* in pomfret stored at 8-10°C or 0-2°C was restricted to <12%. All the *Staphylococcus* isolates from irradiated or unirradiated fillets were weakly haemolytic. Trypsin-activated extracts of fillets from unirradiated or irradiated pomfret gave negative results in the mouse lethal test, indicating the absence of botulinum toxin. AS



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